THE Petroleum Engineer

Dallas, Texas

May, 1932

The New Gulf Building, Pittsburgh, Pa.
Headquarters for
Gulf Refining Company
and Subsidiary Corporations

THE ENGINEERING MAGAZINE OF THE OIL AND GAS INDUSTRY

AT TIOGA PENNSYLVANIA

The folks in the front row are:
(left to right)

J. E. Young, Field Manager for the Taliaferro Corp.
Miss Doris Haynes, a visitor
Wm. Miskimins, Sr., Contractor
J. H. Persson, a visitor
F. A. Donaldson, Union Wire Rope Corp.

Back Row: (left to right)

S. M. Hayes, a visitor
Andy Murvine, Driller
Wm. Miskimins, Jr., Driller
W. H. Fulton, Driller
Harry Atkins, Tooldresser
Homer Miskimins, Tooldresser

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THE Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Edited and Circulated Only for those Actively Engaged in the Operating Departments of the Industry

Published 13 times a year; monthly on the 15th with the exception of June, in which two issues appear—the Engineering Review number on the first and the regular June issue on the 15th.

SUBSCRIPTION PRICE

Single copies 15 cents. Domestic and foreign, $1.00 per year, with the exception of Canada, where the price is $1.65 per year.

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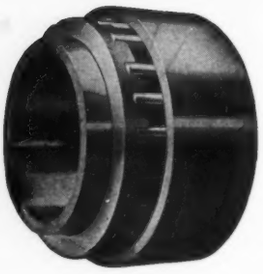
The  Heavy-Duty Standard *for*

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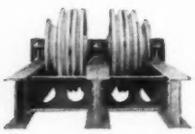
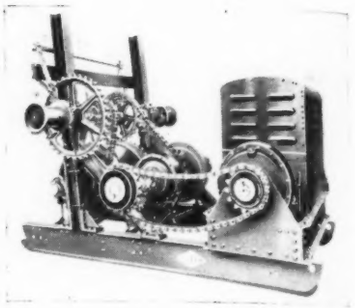
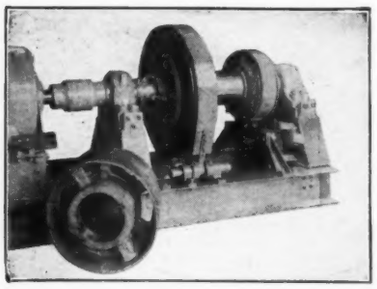

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The Month's HIGH LIGHTS *in* OILDOM

By J. L. DWYER

THE East Texas region still holds the greatest interest of the industry from a standpoint of production and operation, while the Pacific Coast territory will be closely observed by those interested in the legislative phases of our business, especially as they apply to the conservation of oil.

In the vast territory of East Texas, the past week observed the total number of completed wells pass 5,100, a figure never before attained in a single area, especially in such a limited time as that during which the present development has been under way.

As this is written (April 28) the East Texas field is producing 325,000 barrels daily from 5,144 wells. At present hearings are being held before the Texas Railroad Commission to determine what measures shall be adopted in establishing the amount of oil which may be produced for the next three months. The general sentiment of the purchasing companies taking crude oil in East Texas seems to indicate a reluctance to run any more oil than current figures.

The suggestion has been made that in order to pacify some factions in East Texas, meters be placed on all tanks which are connected to pipe lines. It is doubtful if this measure will be adopted.

Drilling activity in East Texas showed an increase during April. For the week ending April 15, one hundred and seventy permits to drill were issued. This figure approximates last year's peak for new permits. Declining bottom hole pressures, as well as ideal drilling conditions and excellent weather, are the causes of the increased activity.

On the Pacific Coast, there seems to be some objection on the part of independent oil producers to a few of the provisions of the Sharkey Bill which comes before the legislature for ratification on May third. Unquestionably the fate of this bill will exert a broad influence upon the immediate future of the oil industry in California. If the measure be defeated, it might mean the cancellation of several oil contracts with an unfavorable crude price reaction. Commenting upon the situation, which is admittedly grave, Ralph B. Lloyd, president of the Oil Producers Sales Agency, after reviewing the plight of the industry in California, states: "There is a way out, however, for all of us. With an approach to the economic allowable of 456,700 barrels daily production as fixed by the economic committee in estimating demand, and with a tolerance over that figure of 5 per cent, we may be able to adjust the situation so that everyone may benefit."

In Oklahoma, the state Supreme Court handed down an important decision when it held that drip gasoline is not natural gas, but is really gasoline, and therefore belongs to the oil company and not the gas company.

Continued improvement in the price which refiners realized upon their products was registered during the past month. The price of gasoline which was two and one-half cents a gallon when the year started, almost reached five cents in April. A general feeling of optimism regarding future prices of gasoline and motor oils seems to be prevalent over the Eastern States and in the Mid-Continent and Gulf Coast regions. Whether or not this optimism is justified by current demands and current consumption can be better determined next month. At least the industry is entering the time of year when a seasonal improvement may be anticipated.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending April 26, 1932

(Figures in barrels of 42 gallons each)

DISTRICT	Per Cent Potential Capacity Reporting	Daily Average Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	444,600	70.2	6,959,000	5,432,000
Appalachian	91.8	93,300	67.9	1,803,000	1,110,000
Ind., Ill., Ky.	98.9	318,100	73.7	6,659,000	4,166,000
Okla., Kans., Mo.	89.6	239,600	55.1	3,909,000	3,094,000
Texas	91.3	501,300	65.5	8,477,000	8,492,000
Louisiana-Arkansas	98.9	172,000	74.6	2,097,000	4,360,000
Rocky Mountain	89.4	32,300	22.5	1,974,000	635,000
California	96.7	471,400	53.3	14,855,000	96,585,000
Total April 16	95.1	2,272,600	62.1	46,733,000	123,874,000
Total April 9	95.1	2,293,100	62.6	47,171,000	123,521,000
Total Apr. 18, 1931	95.7	2,434,100	68.2	*45,893,000	126,835,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.					
Texas Gulf Coast	99.8	379,100	71.3	6,882,000	5,762,000
La. Gulf Coast	100.0	121,000	82.0	1,957,000	3,699,000

Daily Average Production

(Figures in Barrels)

	April 30, 1932	March 26, 1932	April 25, 1931
Oklahoma	395,500	435,900	585,100
Kansas	100,000	98,750	110,050
Panhandle Texas	52,050	46,750	55,300
North Texas	49,450	49,650	57,350
West Central Texas	25,000	24,950	25,050
West Texas	178,700	174,450	218,200
East Central Texas	55,000	55,250	51,650
East Texas	343,450	327,750	248,400
Southwest Texas	52,300	54,300	63,250
North Louisiana	28,400	27,900	39,050
Arkansas	35,000	34,150	46,950
Coastal Texas	110,400	109,050	158,200
Coastal Louisiana	32,850	28,300	27,450
Eastern (not including Mich.)	104,500	103,050	105,300
Michigan	15,450	13,950	8,300
Wyoming	37,600	39,800	43,650
Montana	6,500	6,300	8,650
Colorado	4,150	3,550	4,200
New Mexico	37,550	37,150	39,000
California	517,800	492,100	526,900
Total	2,181,650	2,163,050	2,422,000

NOTE: Stocks at refineries, except in California district, which includes stocks of finished gasoline and engine distillate at refineries, water terminals and sales distributing stations and amounts in transit thereto.

*This figure is not entirely comparable with current stocks due to revisions made since original publication of this figure, for which revisions the basic information is not available by weeks. If it were possible to have made the revision, the new figure would reflect somewhat lower stocks.

Rapid Construction Time Established on M

By J. H.

SMITH BROTHERS Construction Corporation, Kansas City, Mo., pipe line contractors, recently made several impressive construction records in building the first 26-inch gas transmission line laid in the Mid-Continent. The line is the Northern Natural Gas Co.'s 18-mile composite artery from Mullinsville to Clifton, Kan. With close co-operation on the part of the gas company's field and engineering departments and the fact that the purchasing department kept materials supplied to the steadily advancing crews, the contractors were able to complete the line in 88 days.

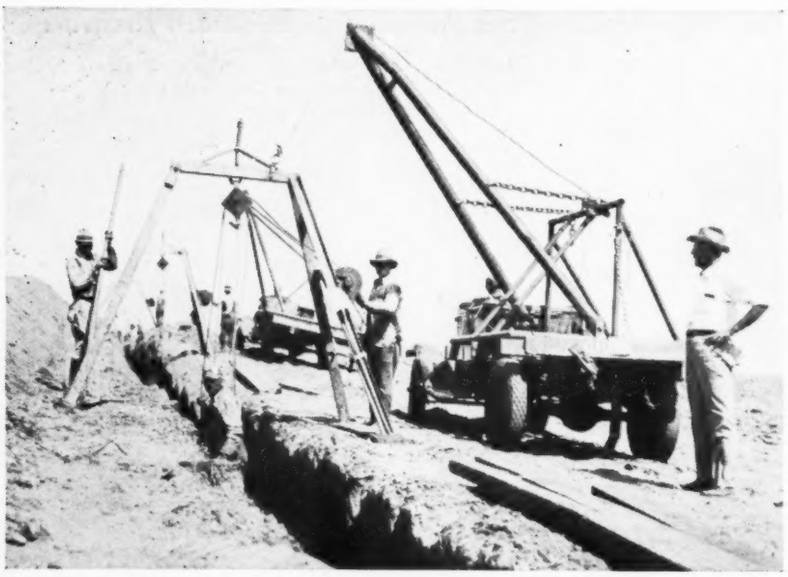
Tieing in an overbend and sag.

Construction work was started with two well-organized crews, each equipped with ample heavy equipment to lay an average of 10,800 feet daily. Most of the equipment was comparatively new or in good repair, consequently little delay was experienced from equipment failures. The best record established during the entire program was the laying of 15,900 feet of line in one nine-hour day by a single crew. When this record was established the crew was moving through flat country which offered easy ditching and a minimum of bends.

Construction work was started simultaneously on the north and south ends of the line. At the outset the big ditchers had little trouble in cutting the 6½-foot trench. The ditch was cut to a width of 36 inches. Most of the country was flat or rolling prairie. In this type of country the ditchers made between 1,800 and 2,000 feet daily. In some sections where the ditching was much easier one machine could cut about 4,800 feet in the course of a 10-hour day. In a few spotted sections the ground was so hard that it was practice for the machine to cut down about three feet on the first run and then double back over the partially cut trench to cut out the remaining three-and-a-half feet.

Considerable rock was encountered on the north end. To cut the trench in this section powder was used to shatter the rock and heavy pull shovels employed to muck out the ditch. This section was so rough and hilly that an average of 20 bends per mile were made.

The most difficult ditching was encountered in the river and creek bottoms, where crews were troubled with caving ditches and water. It was possible to run the machines through the bottom land, but the ditch caved badly and water came in from the shallow water-bearing sands. When the crews were ready to start laying pipe through these sections, clamshells were put to use just ahead of the laying crew. Working along with the crew, portable pump operators kept the water and quicksand pumped down.



Loading collapsible A frame on truck.

The 40-foot joints of pipe were welded into 80-foot sections, lowered into the ditch and lined up for a bell hole joint made with sleeve type couplings. The coupling was bolted tight and painted before the pump's suction line was removed. In some instances the ditch caved so badly that it was 18 to 20 feet wide before the line was tied in.

Stringing did not offer any particular difficulties because rail facilities were close to the right-of-way and, for the most part, roads were good. A truck equipped with

Mid-Continent's First 26-Inch Gas Line

DAMERON

Making hot bend on 26-inch pipe with special rigging.

a special boom was used to lift the 40-foot pipe from the cars and lower it on the trucks and trailers. Ordinarily each of the 22 trucks employed in stringing carried four lengths of pipe. If the roads were bad only three lengths were hauled.

Each construction gang worked in a relatively close spread. The firing line stayed from one-and-a-half to two miles ahead of the paint gang. Each firing line gang operated seven electric welding machines. Five of these were used for the roll welds and two by the tack welders. Other machines were used to make drips, set gate valves and do general repair work, while two machines were held in reserve for emergencies.

The pipe was lined up by means of cranes which placed it on ball-bearing rollers set on top of the skids. In straight country the pipe was lined up in two-length sections, but where a sag or overbend was required it was lined up in three-length (or 120-foot) sections and welded. The laying crew tied each section into the line with couplings.

Welders were troubled considerably with wind and sand during the welding operations. To combat this the contractors devised a special shield. It was box-shaped and made by welded fabrication of three suitable sizes of sheet metal. The bottoms of the sides are cut to fit the pipe and the shield is held in place by two bolted extension legs. The legs are made of 1-inch pipe with a length of pipe of smaller diameter inserted inside. The smaller pipe is held in any position within its limits by means of set screws. With the shield on the pipe the welders experienced no further trouble from wind and sand. The shield is light enough to permit easy turning of the pipe for the weld.

Firing-line welders made an average of 22 welds per day per man. A chill ring was used in connection with the welding and was inserted by the line up crew. About 30 minutes was required to make both beads of the electric weld and approximately six pounds of welding round was required per weld. The firing line welders completed their work 11 days ahead of the laying gangs.

All of the pipe was shipped from the mills with a priming coat. The paint crews, working behind the firing line, applied a cold application of protective coating.

It is interesting to note that the welded sections of pipe were set at an angle to the ditch, instead of parallel, on hillsides. The wind attained such velocity at times that it started the pipe to rolling and, unless such precautions were taken, pipe often was recovered several hundred feet from the job.

Particular attention was given to the hot field bending of the large diameter pipe. Foremen expert in this work were in charge, their crews working behind the paint gang. The equipment consisted of kerosene pressure burners, a fire shield, a bending block and a 30-foot length of pipe, to which a special winch, welded on H beams, was connected. The bending iron was lashed to one end of the section to be bent and the bending block inserted between the two. The pulling line from the bending iron winch was attached to the section of pipe with blocks and the torches and shield set at the point of the bend.

The foreman was instructed by the contractor's engineer

Gate Valve Installation.

Applying soap suds to coupling for test.

as to the degree of bend required and, after the metal was sufficiently heated, a slow pull was started on the pipe. In order better to judge the heat of the pipe the foreman blocked one end of the section to make it darker and it was when the inside of the pipe had become a cherry red in color that the slow pull was started. The pipe was bent a little more than required in order to compensate for its tendency to spring back toward original shape when the tension was released on the pulling line.

After each bend had cooled, and the section appeared satisfactory to the foreman, the engineer in charge checked the work. After this the bend was fitted to the ditch and, when it failed to conform to the curve of the trench, was moved to one side. Before the bending crew progressed too far, it was called back to work over the bend when it did not meet requirements. This careful making of sags and overbends accounts, in large measure for the highly satisfactory manner in which the line withstood initial tests and rendered subsequent service. This, in connection with the composite construction, eliminated much stress at the sags and overbends.

An ingeneous member of the laying crew evolved a novel scheme to clean the inside of the 80 and 120-foot sections of pipe. A swab was difficult to handle in such large-diameter pipe and the workman found he could easily crawl on his hands and knees in the pipe, brush down the side walls with a wire brush, pushing the debris ahead with a sack.

That method, however, being hard on his knees, he rigged up a slide by fastening a roller skate to a padded board. With this odd conveyance the pipe cleaner would, with a wire brush and sack, clean the section better than he could have with the swab.

Much of the construction speed was due to the rapidity of the laying crew and lowering gang in carrying out their work. The large hoists lifted the sections over the trench and on the skids. As each section was lined up, the couplers tied the line in with sleeve couplings which were painted after the last bolt had been tightened.

By using a new type of lowering horse the lowering gang easily kept pace with the crew ahead. This is nothing more than a steel A frame equipped with a 5-ton BB winch and necessary pulley blocks and lines. One leg of the A frame swings on a bearing, permitting it to be folded against the side of the frame, which renders it easy to transport. The frame is attached to wood bases to prevent sinking in soft ground and, complete, it weighs 850 pounds.

To move this equipment along the line speedily the contractors built a special bed for a light truck. I beams were welded to the truck frame to give it greater strength and double springs were put on. The truck bed was equipped with a large boom, braced as shown in the accompanying photograph. When it is desired to move the lowering horse, the truck is brought alongside and the line coming from the winch on the truck is hooked to the A frame.

As the line is reeled in, the A frame is raised and the swinging leg falls against the side, striking against a bumper on the side of the truck. The truck swamper continues to reel in the winch line which pulls the truck boom and the A frame to a vertical position over the truck bed.

In lowering in, six of these frames are working on the line and one is moving all the time. One truck, serving as a shuttle truck, does practically all of the work, although a second truck is always available for emergencies. As soon as the pipe is in the ditch at the last lowering horse, the operator uncouples the sling, reels in his line and makes ready to be moved. The truck driver and swamper hook on to the equipment, raise it and drive to the next location.

The A frame operator travels with the truck and assists in putting the A frame in position on the new location. As soon as the truck driver unloads he returns to the other end of the gang in reverse gear. The lowering horses are spaced 80 feet apart for the lowering in operation. While it is difficult to conceive, the lowering horses were moved, in good territory, at the rate of one per minute.

The line was spot backfilled as fast as it was lowered to hold it in the ditch. Gate valves were lowered about every 8½ miles and, as soon as a valve was in place, a test was made. A 20-inch gear-operated gate with a factory-made swage nipple and Murphy type by-pass was installed. Gas was kept coming behind the laying crew and when the valve was in place the line was blown and then the gate closed for a test.

By spot backfilling all of the joints were left open for a soapsuds test of the welds and couplings. Whenever a leak was found it was repaired at the time. All of the welds held and the only small leaks developing were those due to improper tightening of the coupling bolts when the line was laid. As soon as a section passed its test the remaining backfilling was finished.

Virtually all of the equipment used during construction was the heavy type. The ditching was done with six large machines and right-of-way clearing was accomplished with a large bull-dozer and the three pull shovels. Nine cranes and seven backfillers, along with 10 tractors, made up the rest of the heavy equipment. Additional equipment included 11 air compressors, 26 trucks, eight pick-up cars, seven passenger cars and 27 welding machines.

The organization was under the direction of Charles S. Foreman, president of the construction company, and field work was done under the supervision of H. J. Pierce, general superintendent, and John Eddleman and R. T. Wenworth, superintendents of the south and north gangs respectively.

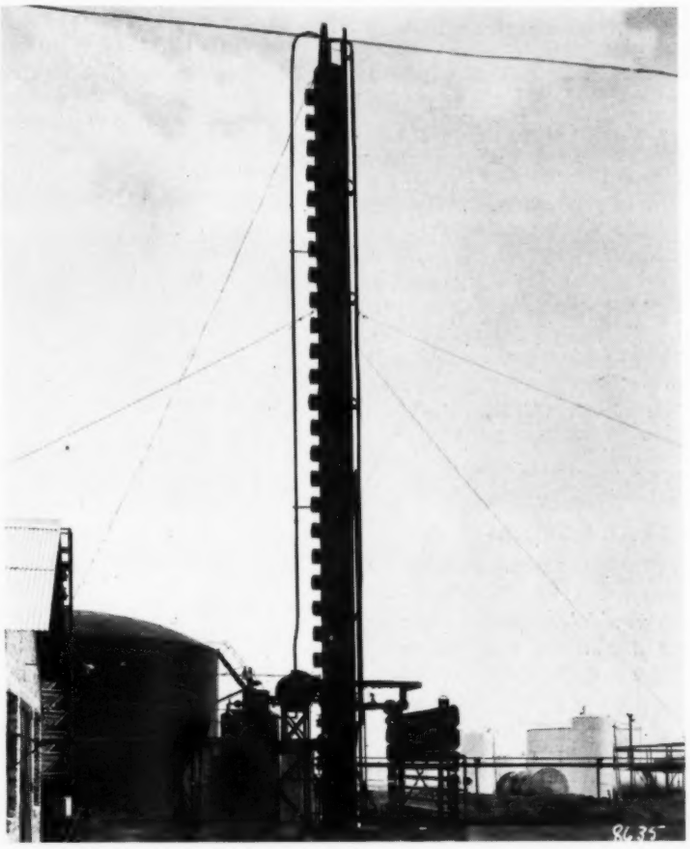
Good workmanship was not sacrificed for construction speed as is indicated by the final test of the line. A pressure of 400 pounds was put on the line and then all section gates were closed. Gauges had been previously installed on each section. The pressure held without a drop for three days. To accomplish the construction work in such a short time the contractors were afforded every co-operation by the pipe line company engineers and material men.

Development *in* Natural Gasoline Manufacture

By F. R. STALEY

THE new grading system for natural gasoline, based on the vapor pressure specification, enables the refiner to obtain a material that will best meet his requirements. These specifications determine plant yields and the use to which a product can be put. More than 90 per cent of the natural gasoline produced in the country is blended into motor fuel. The lower vapor pressure products can be used as a premium motor or for aviation gasoline.

Refiners have always been the largest purchasers of natural gasoline, using it to raise the gravity of their motor fuel or to supply greater volatility at lower temperatures for easy motor starting in cold weather. In recent years the high compression automotive engine has created an enormous demand for high octane gasoline, and in order to supply it American refiners have greatly increased their cracking capacities. Vapor recovery and stabilization plants have been installed in most refineries for conserving the light fractions produced by cracking, consequently the refinery demand for natural gasoline has decreased.



Natural Gasoline Stabilizer at plant of Eason Oil Co., Enid, Okla.

The output of natural gasoline in this country has decreased also during the past two years. According to the U. S. Bureau of Mines survey[1] the production in 1931 was 18 per cent below that of 1930. This decline resulted manly from the curb placed on drilling. In addition, East Texas, the only area which had a material amount of flush crude production in 1931, was unique in not having a gas-oil ratio sufficiently large to invite the construction of new plants until the year was practically over.

According to the survey, nearly all of the states and fields reported a decrease in natural gasoline output in 1931. The largest declines occurred in the Seminole and Santa Fe Springs districts. The only field which showed a material gain in output in 1931 was the Kettleman Hills field, now the leading natural gasoline producing area of California. Although the output in the Texas Panhandle declined, that area became the leading producing district of the country.

The technical committee of the Natural Gasoline Association of America has analyzed the supply factors created by the new grading system. Each plant is definitely limited as to the number of grades it can produce under the new system. If a plant normally produces a 26-70 gasoline, it cannot normally yield a 26-55 gasoline. If the demand is for 26-pound gasoline, this plant must sell in a market that requires 70 per cent or more at 140 deg. F. The vapor pressure of its product cannot be lowered or raised without raising or lowering the per cent at 140 deg. F. Very approximately, a decrease of one pound in vapor pressure is accompanied by a decrease of one per cent at 140 deg. F. In reducing the product of such a plant to the 22-pound limit it may still maintain its position in the brackets for 70 per cent at 140 deg. F., or it may be moved slightly within the 55 per cent at 140 deg. F. bracket. Similar conditions will apply at each vapor pressure limit, because whatever the distillation characteristics may be they are sharply defined and relatively inflexible for each vapor pressure limit.

These basic distillation characteristics depend on the properties of the pentanes and heavier fractions in the natural gasoline. Fortunately the pentanes and heavier of some 80 to 90 per cent of natural gasoline is very much the same, at least in regard to distillation characteristics. From these considerations, it follows that the supply of natural gasoline in relation to the distillation characteristics is quite rigidly fixed.

The loss in plant yield due to reductions in vapor pressure of natural gasoline is comparatively unaffected by the characteristics of the pentanes and heavier. The loss in passing from one vapor pressure limit of the new grading system to the next lower limit will be in the neighborhood of 11 to 15 per cent, regardless of the distillation characteristics. This condition places all plants on the same plane in regard to the vapor pressure specifications. There is no such flexibility or common basis in regard to the distillation characteristics. Consequently the vapor pressure specification is the predominant economic factor as far as supply is concerned.[2]

It has been fairly established that the plant yield basis for the new gasoline grading system is economically sound for both buyer and seller.

Plant Control by Vapor Pressure

Under the new grading system vapor pressure determi-

nation alone guides the plant operator. Plant yields and the quality of the products being shipped are functions of the vapor pressure. Felton[4] states that in plants having efficient fractionating equipment whereby the desired control of vapor pressure may be maintained on the kettle product, or the overhead product, or both, the Reid Method will be of great value and will offer the best opportunities for its use in fractionator control. In many plants the method is useful for control work, but it is of primary importance as a shipping limitation. In the case of manufacturing grade 26-70, for example, it is necessary in most cases to check the vapor pressure in stock tanks with the California type bomb. If a 26-pound vapor pressure is the maximum allowable, the wise operator will make a product having a vapor pressure of 25.5 to 26.0 pounds, preferably 25.8 pounds.

Many gasoline plants are now equipped to manufacture natural gasoline of very low vapor pressure. Stabilizing equipment and automatic control instruments for rate of flow, liquid level, temperature, and pressure have been constantly improved so that efficient plant operation can be constantly maintained.

The larger gasoline plants built in East Texas were built primarily as gas conservation plants. The stripped gas from the plant is put back into the producing sand. While most plants process casinghead gas the number of plants built by transportation companies to treat gas for pipe lines has increased. The purpose is to purify the gas and remove water and gasoline which might cause interruption in service due to blocking the lines with liquids or ice formations.

MERITS OF NATURAL GASOLINE

The superior qualities of butane-free natural gasoline for use in motor fuel are:

(1) High effective volatility, which improves starting, warming up, and under some conditions, acceleration.

(2) Octane number from 64 to 70.

(3) Extremely high responsiveness to Ethyl Fluid.

(4) Maintenance of anti-knock characteristics over a wide range of engine conditions.

(5) Very low sulphur content.

(6) Very low gum content.

(7) High gravity.

(8) Low end point.

Butane-free gasoline is primarily a winter gasoline but it can be used in large percentages in the summer time. Its volatility characteristics are such that it can be easily and cheaply stored. It has been successfully stored on a large scale in crude oil tanks.

If the refinery light ends exceed the demands of motor fuel market it is suggested that refiners purchase butane-free natural for use in large proportions in premium grades of motor fuel.

TRANSPORTATION

The transportation of natural gasoline in crude oil pipe lines from the gasoline plant to the refinery is successfully carried on by some companies. One of the larger oil companies uses this means of transportation from its plants in Oklahoma to a refinery near St. Louis. The cost of freight to the refinery is an important factor as refineries are being concentrated at centers of consumption with pipe line delivering of crude oil. Natural gasoline must be produced where found and is usually transported by rail.

With properly equipped storage, blends of motor fuel can be made at the bulk station if the refiner wishes to save a substantial part of the in and out freight.[2] It is to the refiner's advantage to ship partially debutanized or butane-free natural gasoline to his bulk station for blending, as against using any natural gasoline in the refinery. Instead of paying an in and out freight on natural gasoline he can use the freight saving to pay a premium for the more stable natural gasoline. It should be understood that natural gasoline is produced from gas that cannot be conserved. It must be produced from day to day. It is produced regardless of price, since the manufacturer has to pay for the raw material whether the gas is utilized or not. Enormous investments have been made in plants which cannot be readily abandoned.

The new specifications for natural gasoline were described in THE PETROLEUM ENGINEER, January, 1932, page 54.

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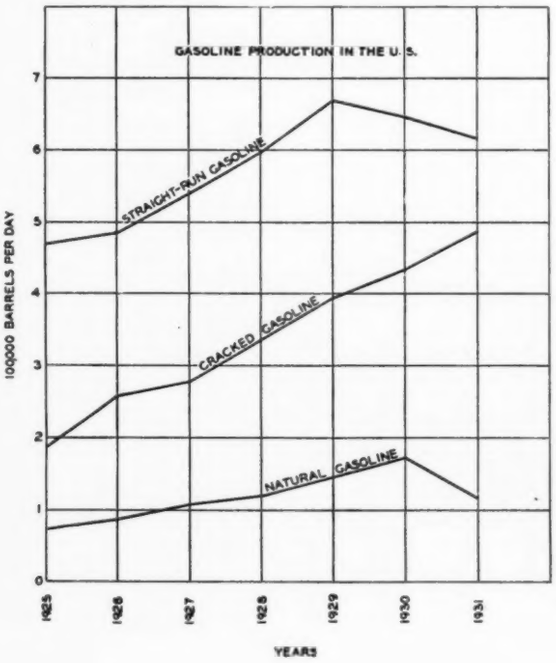
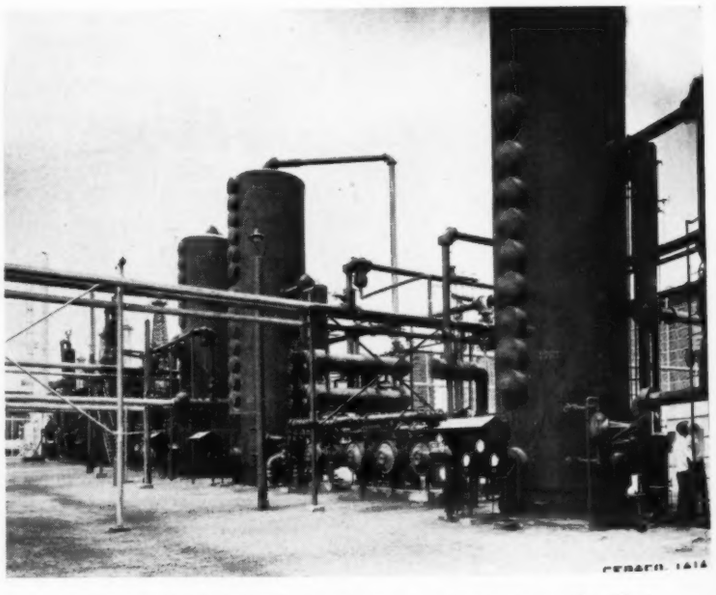
(1) U. S. Bureau of Mines Annual Petroleum Statement, No. P. 89.
(2) Emby Kaye, Value of Natural Gasoline, W. P. R. A., April, 1932.
(3) Technical Committee, N. G. A. A. Report, Dec. 30, 1931, also Memo. A1-152-31.
(4) W. L. Felton, New Vapor Pressure Methods, March, 1932, Ranger, Texas.





Heat exchange and control equipment in a California gasoline plant.

Study of
Bottom-Hole Pressure Measurements
Aids in Better Well Operation

By K. C. SCLATER

A NEW technique is undergoing rapid development in the East Texas field that is of interest to everyone concerned with oilfield practice. Simultaneously with the development of the field, changing physical conditions within the reservoir are being closely followed. Positive bottom-hole pressure and temperature measurements are being taken at intervals on a group of selected wells by means of recording pressure instruments and thermometers. From these records, a comprehensive picture is obtained of the changing physical conditions in the sand, especially in regard to the rate of rock-pressure decline. Although this branch of underground study in the production of oil is in its infancy, it is proving to be one of the most useful and positive tools that the production engineer has yet had at his command.

Arrangement on back of car for screwing up the bomb after insertion of the chart. Note the reel containing the Halliburton steel measuring line. The V-belt is disconnected while running in.

At last, it is beginning to be realized that studies in connection with bottom-hole measurements have an important and wide application to the solution of oil development and production problems. Heretofore, the investigation of flow of fluids through sands has been confined chiefly to laboratory experiment. Research work of this type, though fundamental and vital to progress in efficient production practice, has received little or no aid of a practical nature from the field producing branch of the oil industry. This, of course, is attributed largely to the lack of suitable equipment and instruments of sufficient accuracy for taking positive bottom-hole measurements. Another factor that has retarded progress in making field investigations of bottom-hole conditions of a worth-while practical nature has been the lack of agreement among operators as to the proper procedure and general principles that should be observed in the development of an oil pool.

It is now generally recognized that gas in any form associated with the oil in the sand is a valuable source of energy that, when properly utilized, can reduce lifting costs and increase ultimate recovery. This has brought about the now common practice of measuring, in addition to the oil, the volume of gas produced by a well. When the volume and composition of the gas and oil are definitely known at all times, and also the temperature and pressure of the fluids in the sand at corresponding intervals, the size of the reservoir and its rate of depletion, assuming no water is present, can be computed from the well known physical laws of gases and liquids.

If edge or bottom water is present, as in the East Texas field, hydrostatic pressure and the rate of water encroachment must be taken into account. Hydrostatic pressure will be an important component of the rock pressure, hence will influence the rate of rock pressure decline. The rate of water encroachment will act to change the size of the reservoir. These are factors that must not be overlooked in any calculations involving decline of rock-pressure in East Texas. It is obvious that the neglect of hydrostatic pressure and rate of water encroachment in calculations involving the extent and life of the pool would give highly erroneous results.

There are three types of recording bottom-hole pressure instruments in the field. One, the Amerada instrument, has a common gauge-pressure element and is of the continuous recording type. This is the bomb most widely used in the field. It is described in a recent paper.[1] This was the first commercial instrument developed for this purpose. A second make of instrument is used by the Humble Oil and Refining Company. It is also a recording instrument but gives instantaneous readings only at any desired depths in the well. Pressure from the well is transmitted through a plunger, which in turn actuates the recording apparatus. Several of these instruments are expected to be in use in the field shortly.

A third make of instrument is in use by the Gulf Production Company. The pressure element consists of a hydrogen-filled steel chamber. This instrument is said to be quite accurate and successful in use.

There are other makes of instrument being developed and it is likely that a variety of bottom-hole pressure bombs will soon be available on the market.

The accompanying illustrations show a bottom-hole pressure test being made on a well, and the apparatus used for running the instrument in the hole. In the equipment shown, a pulley is fitted to the hub of the left rear wheel of the

[1] "Bottom-Hole Pressures in Oil Wells", by C. V. Millikan and Carroll V. Sidwell. A. I. M. E. Petroleum Development and Technology—1931, p. 195.

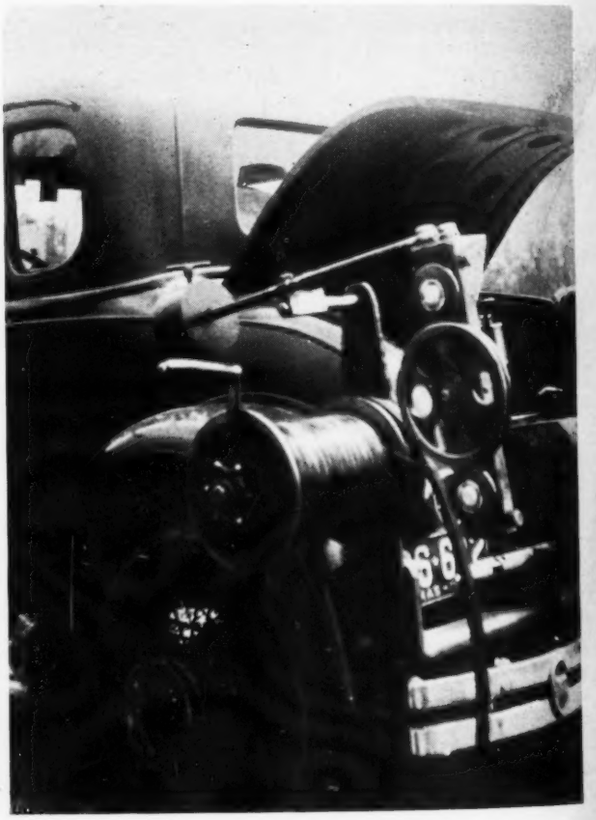
Placing the bottom-hole pressure bomb in the tubing.

car for pulling out. As can be seen, the instrument is run inside the tubing on a Halliburton steel line, with depth integrating apparatus complete. With the well shut in, a bottom-hole pressure test can be made in one hour. This is for the well of average depth in the East Texas field.

There are, at this writing, twelve bottom-hole pressure recording instruments in everyday use in the East Texas field. In order to follow the decline and adjustment of rock pressure in the pool as a whole, and to eliminate possible duplication of field work, static bottom-hole pressures are being taken on 219 specially selected wells in the field at regular intervals. All companies having bottom-hole pressure instruments contribute to this survey and their representatives meet at stated times to check, compare, and exchange information. This work is purely co-operative and only those contributing aid, share in the information compiled. Each company, after obtaining this information, can place its own interpretation on the data.

In addition to shut-in bottom-hole static pressure readings, some companies are taking bottom-hole pressure readings while the well is flowing. Readings are taken under different rates of flow and the results plotted and analyzed. The production engineers of several companies in the field are making an intensive study of bottom-hole data with respect to the flow characteristics of individual wells. Valuable data are being gathered on the relationship between the bottom-hole pressure drop and amount of penetration for different rates of flow. Recently a report, prepared by two production engineers, each of whom is with a major producing company, was read before a group of engineers in the East Texas field. It dealt with the completion of oil wells in this field. They divided the field into four zones and submitted recommendations for the proper amount of penetration for wells in each zone. Their recommendations were based on a series of tests made in wells of various penetrations. Data taken consisted of bottom-hole differential pressure, gas-oil ratio, gravity of oil, and viscosity of oil, for different rates of flow. In addition, the bottom-hole pressure at the maximum rate of well flow was observed where this could be conveniently done.

Five wells were tested and curves of the data plotted and analyzed. All wells were somewhat similar in indicating certain flow characteristics. Among other things, their data indicate that: (1) The flowing bottom-hole pressure varies directly with the sand penetration; that is, the greater the sand penetration the higher the flowing bottom-hole pressure. Stated in another way, the greater the penetration, the smaller the flowing differential pressure between the reservoir and the hole; or, the flowing differential pressure in the sand varies inversely with the sand penetration. (2) The smaller the sand penetration the greater the rate of drop in bottom-hole pressure as the flow is increased. (3) A minimum gas-oil ratio occurs at rates of flow between 20 and 40 barrels an hour. (4) There seems to be a direct relationship between the rate of gas-oil ratio increase and



Close-up view of the driving pulley on the hub of car wheel for transmitting power to steel line reel while pulling out the pressure bomb.

Martin Breddy Research Library

the rate in pressure drop at the sand face. (5) Wells of shallow penetration produce oil of a slightly higher gravity (A. P. I.) than wells of deep penetration.

In presenting this information here, the purpose is to show the scope of usefulness to which bottom-hole data has been extended to everyday problems of oil development and production. It should be borne in mind that these tests were made and positive measurements obtained. The analyses of the data itself demonstrate the highly practical nature of the results. It is not implied that these findings apply to all wells in the field. Groups of wells in certain areas where physical conditions in the reservoir are similar would be expected to show similar characteristics. As to the rock pressure found in different areas of the pool, these range from 1000-lb. per sq. inch in the old Joiner area to 1500-lb. per square inch on the west edge of the pool in the north end of the field. As new wells are added the allowable quantity of oil per well is reduced, while the daily total allowance from the field remains unchanged. The fact that the oil is produced from an increasingly greater number of wells, hastens the adjustment of pressure over the whole field. In the low-pressure areas the rock-pressure is increasing slowly, and in the high pressure areas, slowly decreasing. In the western half of the field, virtually all of which has bottom water, the rock pressure is declining at a very slow rate. It is believed that, at the present rate of production from the field, the water is following up in the sand almost as fast as the oil and gas are removed from the reservoir, thus maintaining the rock-pressure. It is obvious that this action resulting from the hydrostatic head of water will be most effective in this area. Estimates at this time as to the amount of increase in the level of the water table due to withdrawal of oil and gas can only be conjecture. In the first place, almost all wells in the western half of the field have been completed at a depth well above the level of the original water table in the field; and second, in those wells that are making water, there may be water-coning in the sand surrounding the well that would prevent obtaining the true water level in that well.

As to the direction of water encroachment, experience would justify the belief that the water will follow the bedding planes in the sand, in which case the water will encroach not directly upward or directly eastward but in a direction between these two.

So widely different have been the estimates of average net thickness and porosity of the sand that it seems futile to make any estimate on the rate of water encroachment on the basis of volume measurements by displacement.

Should the rate of development continue as at present the field will be completely drilled by the end of this year. After this time, if the production from the field is still under restriction, bottom-hole measurements will be among the most valuable of all the data for making accurate estimates of the probable life and ultimate recovery of the field, for then the withdrawal from all parts of the pool will be fairly uniform and by then also, the accumulated data on sand conditions, in addition to bottom-hole pressure studies, will indicate more clearly the underground conditions in the field.

As closely as can be ascertained, the average decline in rock-pressure for the field is estimated at 8 to 12-lb. per sq. inch per month. This is based on the present restricted rate of production of 340,000 barrels daily.

Estimates on the natural flowing life of the wells will depend on their location in the field, and also on the rate of production from the pool as a whole. Many wells along the east edge of the field where the sand is thin may not have a life longer than six to nine months, and in these, paraffin trouble may be just as important as rock pressure in determining the length of flowing life. It is questionable whether or not after the field is completely drilled, wells on the east edge will feel any effect of the water drive from the west side of the field, especially wells in those areas where the field has its greatest width.

By the time the rock-pressure reaches the point at which gas begins to come out of solution there should be available enough bottom-hole pressure data from which accurate estimates can be made regarding the future of the field.

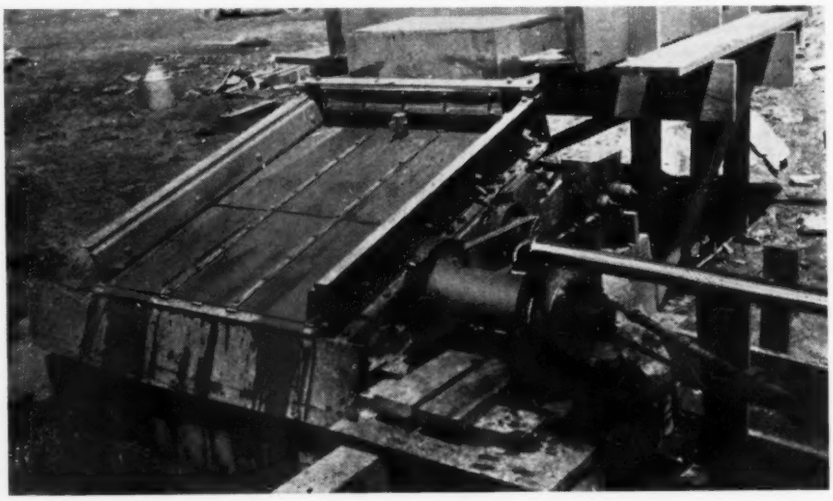
Much of the technique in taking bottom-hole data and methods of interpreting the results developed in the East Texas field will be applicable to other fields, thereby giving an added impetus to the science of producing oil not only from individual wells, but from the pool as a unit.

Especial care is exercised in running in or pulling out the bomb. Here the bomb is being pulled out of the hole.

Drilling Mud Importance Increases

THE many valuable functions performed by rotary mud fluids in connection with oil well drilling operations become more important factors as hole penetrations are extended to greater depths. There has, consequently, been an increasing practice, particularly on deep wells and where high subsurface pressures are encountered (as is usually the case on all deep tests) to devote more and more study to securing the mud with characteristics best suiting it to the hole-condition and to the area in which drilling is being done.

Mud functions in drilling include removal of cuttings from the hole; sealing off of the hole walls; consolidation of loose formations to prevent their caving into the hole; lubrication of the hole walls, drill pipe, casing and slush pumps to reduce friction; holding in suspension all solids during intervals when circulation is stopped; and provision of sufficient hydrostatic pressure to confine gas, oil or water to their respective formations.



A vibrating mud screen on a Hobbs, New Mexico, drilling well.

The deeper the hole the more difficult and the more important it becomes to have these duties satisfactorily performed. Proper performance of all functions, with the exception of hydrostatic pressure, can be obtained by concentration of active colloidal matter in the mud, which gives the mud a sticky gel characteristic, but it must still retail its live, fluid nature. In other words, the mud should be viscous yet as fluid a mixture as possible. This characteristic may be considered the most essential property of a good drilling mud. In addition, a good mud will have a uniform consistency and appearance and will be free from large solid particles.

The gel feature of a mud may be determined by letting a sample set for 10 to 15 minutes in a glass jar or tube. At the end of this period the mud should have reached the gel state; however, it should quickly revert to a fluid state when agitated. After standing there should be but little trace of free water on the surface and but little sand in the bottom of the container. Another method used is to place a quantity of fluid in a container with a small aperture in the bottom and time its draining flow. These appear to be the best methods for testing rotary mud viscosities in the field.

A thin mud of the proper viscosity will be highly plastic and will quickly form an adhesive film on the drill pipe and casing, and in addition, will seal off non-solid formations, thereby becoming highly efficient as a sealing and lubricating factor, and its sticky nature will satisfactorily perform the first requisite of mud-laden drilling fluids: the removal of cuttings from the hole.

The difficulty of conveying cuttings from the hole is enormously enlarged with increasing depths, as a greater carrying capacity is naturally required to bring cuttings to the surface from the bottom of a deep hole. A too low carrying capacity mud will materially slow-up the cutting action of the bit by its failure to remove cuttings from the bit rapidly enough.

An example of the important part mud plays in the drilling speeds of rotary rigs is clearly shown in one case at Kettleman Hills, California, where the addition of 20 sacks of commercial mud in a 3,500-foot electrically drilled hole so reduced friction (thereby increasing the speed of drill pipe rotation), that the driller thought a twist-off had occurred, and immediately pulled the drill pipe from the hole. In this instance, because of its lubricating action and faster removing of cuttings, the better mud permitted the use of about one-half of the former power requirements to maintain the same speed of rotation.

The most important factor in determining the carrying capacity of any drilling mud is its suspension quality, which may be governed by controlling the mud viscosity or adhesiveness to a range where it is viscous enough to trap and pick up all cuttings and still be fluid enough for easy pumping and to insure efficient cutting settlement in the settling ditch.

While cuttings are kept in suspension better with greater viscosity this quality is governed by the facility with which the slush pumps pick up a highly sticky mud and necessary rapidity of settling out all cuttings. Since the pumps will labor on too high viscosities, their volumetric efficiency will be reduced and the velocity of flow naturally lowered. The velocity of mud stream flow is another factor in improving rapid displacement of cuttings from the bit. The higher the rate of flow, the faster the removal action; but the velocity cannot be permitted to become too great or the side walls in an open hole will be badly scourged. Because of these considerations the best mud must have gel characteristics to carry cuttings, yet one which is not too dense to hinder pumping and settling action. Special ingredients are very frequently needed to secure such a standard in muds and it is very rarely on deep wells that such conditioning is not necessary.

Many companies now use mud reclaiming plants of either the vibrating screen type or more elaborate devices to aid in securing the proper conditioned mud and to quicken settling action of cuttings. The vibrating screen, powered by steam or electricity, is set up in the mud system at the

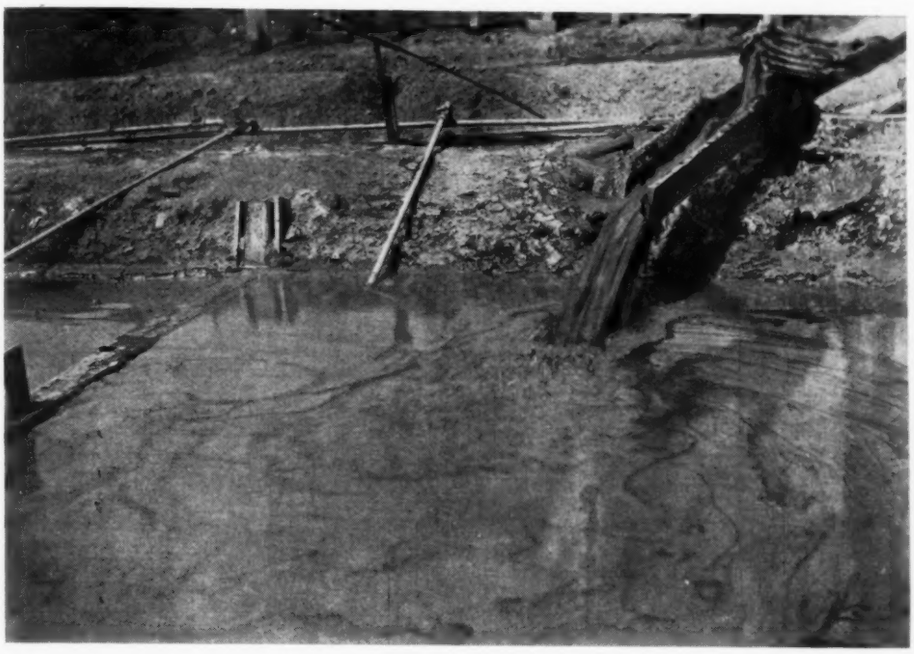
With Depth *of* Hole

By
WARREN L. BAKER

individual well so the mud flows over the screen after emerging from under the derrick floor. In passing over the screen all the larger, individual particles will be removed from the mud.

The vibrating screen has proved valuable not only for speeding removal of cuttings and reducing pump repair costs, but has cut down slush pit costs, requires less mud, assists in liberating suspended gas and oil, and keeps the mud in a mooth, consistent condition.[1]

Where central mud conditioning plants are used the mud is usually thinned back with water to increase the speed of liberating cuttings. Afterwards the excess water is centrifuged off and the mud again mixed to the proper viscosity and weight for drilling purposes.



Mud stream return ditch to slush ponds.

The consistency of mud laden fluids should be varied according to the conditions for which it is employed. The most frequent mixings for normal conditions are those with a specific gravity of 1.05 to 1.15, the weights of which range from 8.75 to 9.60 pounds per gallon. This type of mud is considered a thin one and is unsuited for mudding off high pressures, although it may perform all other duties perfectly.

Whenever excessive pressures are not encountered, the drilling mud can be controlled in the field by weighing it daily, keeping it below 72 pounds per cubic foot (9.6 pounds per gallon) by the addition of water when necessary and adding matter to keep the colloidal properties and viscosities constant, but the weight must necessarily be increased where high pressures are found and still kept thin enough to be plastic so as to consolidate the loose formations.

There is a vast difference between thick and heavy muds, although thick muds always appear heavy. The weight of a thick appearing mud will often vary from nine to 14 pounds per gallon. It is a good practice, and one frequently adopted on deep wells, to weigh the mud at regular intervals during the day. Several devices are now available for this purpose. The thick muds are more easily gas-cut than thin ones; hence, when drilling into pressure zones it is desirable to use a heavy-weight mud which is as thin as will conform to the desired density. High specific gravity and colloidally inert substances, such as several commercial clays, will produce this type of mud when mixed with the native fluid.

The hydrostatic pressure exerted by the weight of the mud column is the controlling factor when drilling in a heavy pressure formation exposed in the open hole. The density or weight of the mud at such times must be great enough to produce a hydrostatic pressure at the bottom of the pressure zone in excess of the formation pressure. Ample hydrostatic pressure is dependent upon quantity of specific gravity in the solids contained in the drilling fluid.

At Oklahoma City all drilling in the upper portions of the hole was done with 9.5 pounds-per-gallon mud, but upon reaching a depth where the high pressure formations were encountered the mud was increased to approximately 11 pounds per gallon in weight.

Mud forming strata are penetrated in some fields and, in these cases, when high pressures are not present, only water is added to the circulating system in order to thin back the native mud. In other regions the amount of mud forming strata found is negligible and commercial compounds must be added for safety and best drilling conditions. With deeper drilling and the more important part played by muds special ingredients are practically always needed properly to condition the mud for satisfactory drilling results.

The mixing of commercial muds with native mud (or water) already in use is a very important item. It should be mixed in such a manner that every particle is wetted and so the resulting mixture does not contain lumps. There are several generally used means of mixing, including the box mixer, pipe and drum type mixer and the jet type. All of these mixers provide the proper quantities by using a one-inch stream under pressure from the slush pump. The finished mud mixture is discharged into the slush pit.

The method of using commercial clays is to add small quantities daily of every few days. If a well has been drilling with ordinary 9.4 pounds-per-gallon fluid and it is desired to condition it, the mud should first be thinned

[1] Elaborate Systems for Handling Muds in Hobbs, by Robert S. Christie, The Petroleum Engineer, November, 1930.

Automatitc mud indicator, Hobbs, New Mexico, field.

back with water so that it weighs approximately 8¾ pounds per gallon, which will allow all sand and foreign matter to settle out. The amount of commercial clay to be added will depend upon the original mud and its present condition as well as to the weight of mud wanted.

Rotary drilling muds are essential factors in running all long strings of casing, by which operation the pipe is floated into the hole. The bottom of the casing string is equipped with float shoes and collars and the pipe is kept fairly full of mud during running operations. This action reduces the stress and strain imposed by heavy pipe strings on surface rig equipment. It is estimated that the dead weight load of the pipe will be reduced approximately 50 per cent by this method with the proper weight mud.

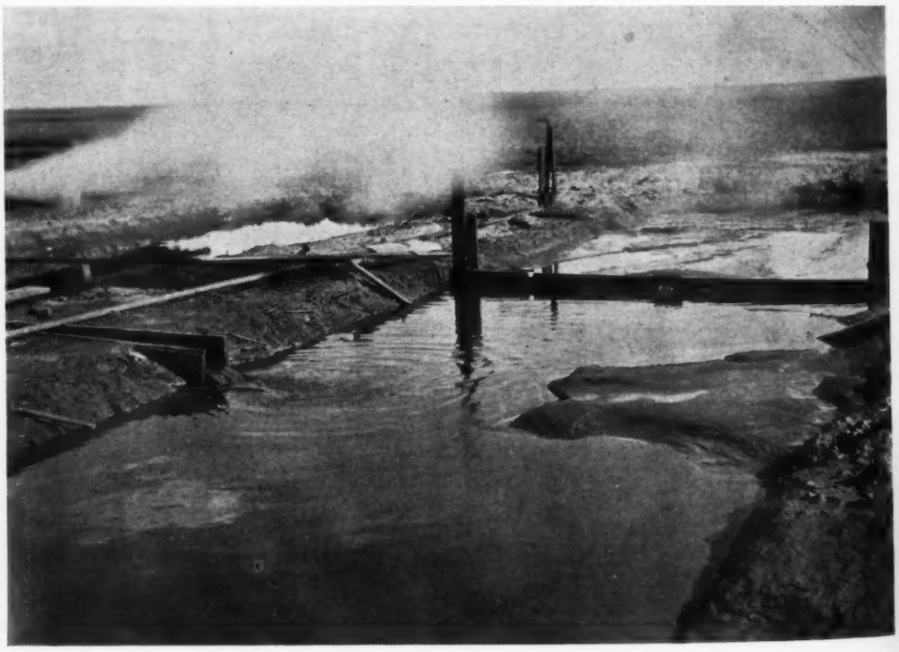
Muds also play a vital part in all cementing operations, being used to condition the hole prior to running the pipe and later by circulating several hours before cementing. Prior to cementing the mud is conditioned, which includes cleaning it of all solid particles and it is thinned back as far as adequate safety factors will permit under the particular conditions. It has been found that cementing operations are much easier, quicker and more successful where such action is taken.

More recently, muds have been used to cool high bottom hole temperatures by placing many tons of ice in the slush ponds. After the mud in the ponds has reached a temperature of about 40 degrees F., it is circulated long enough to lower the bottom hole temperature, which otherwise would accelerate setting action of the cement.

Specific Gravity	Pounds Per Cu. Ft.	Pounds Per Gallon	Specific Gravity	Pounds Per Cu. Ft.	Pounds Per Gallon
1.00	62.3	8.33	1.50	93.6	12.52
1.05	65.5	8.75	1.55	96.6	12.93
1.10	68.6	9.18	1.60	99.7	13.34
1.15	71.8	9.60	1.65	102.9	13.76
1.20	74.9	10.00	1.70	106.0	14.18
1.25	78.0	10.43	1.75	109.2	14.59
1.30	81.2	10.84	1.80	112.3	15.01
1.35	84.3	11.26	1.85	115.4	15.42
1.40	87.4	11.68	1.90	118.5	15.84
1.45	90.5	12.10	1.95	121.6	16.26
			2.00	124.7	16.67

TABLE OF SPECIFIC GRAVITY AND WEIGHT EQUIVALENTS*

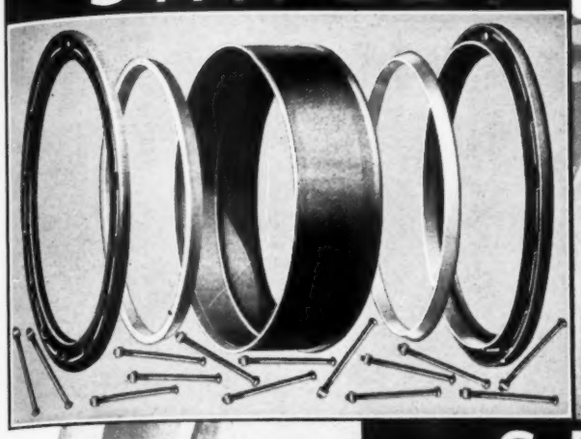
*From Drilling Handbook, Baroid Sales Co.



A slush pond, note settlings opposite return stream.

Reference: Drilling Mud Handbook, Baroid Sales Company, Los Angeles, California.

SIMPLE



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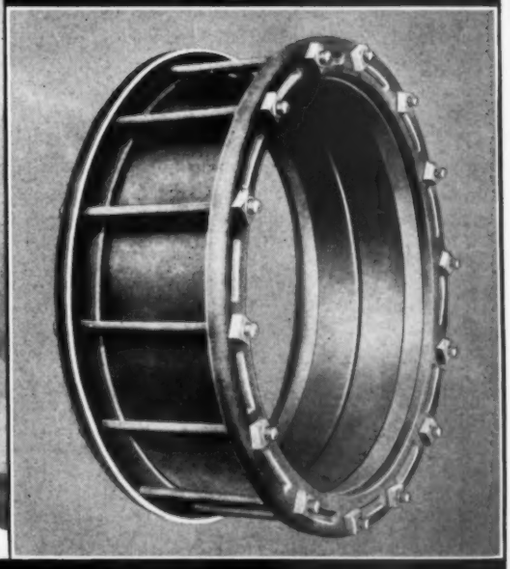
SPEEDY

TIGHT



Wherever a big gas main or a long-distance line is laid in record time . . . or wherever the going is rough or the need for strong, flexible, durable joints is imperative—Dresser Couplings dominate. "Dressered" lines provide for all movements due to expansion, contraction, shifting ground, vibration and other strains. Maintenance is nil.

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DRESSER COUPLINGS DOMINATE!

Stringing Large Diameter Gas Lines in Rugged Country

• ● •

IN the construction of large-diameter gas lines through part of the mountainous country of the East, especially in Kentucky and the Virginias, stringing pipe is often one of the most difficult of the construction problems. In parts the country is extremely rugged, broken by sharp-climbing ridges. Some of these ridges rise on a 45-degree angle.

Where such country is encountered it is almost impossible to string pipe with trucks and trailers or teams and wagons. Snaking the pipe up the side of the ridges with teams is equally difficult and is a slow, tedious job.

To facilitate stringing in such territory the Hope Engineering Co., engineering contractors, Mount Vernon, Ohio, uses a double drum winch with success. The winch is mounted on the rear end of the tractor where it will not interfere with the drawbar work of the machine. It is operated from a special power take-off at the rear of the tractor and controlled from the driver's seat, where all winding operations are in full view of the operator. The winch does not run while the machine is being "roaded" and the drum may be disengaged from gearing when free action is desired. The winches have four distinct drum speeds and the drums are built for large line capacity. They are also equipped with a snubbing spool and may be installed in the field.

It is the practice of the Hope company to have the stringing crews unload sufficient pipe at the foot of the inclines. On the steep hills both drums are used simultaneously. When this procedure is followed one drum is used to drag the pipe up the hill while the other drum is unspooling its line for the next length to be placed. A pulley block is anchored at the bottom of the hill, through which the unloaded line is pulled to the bottom for its load.

When both winch lines are used, each is equipped with a hook, and sometimes a special clamp is used to attach the line to the pipe. Frequently wooden plugs or else regular pipe protectors are used to prevent battering of the ends as the pipe is dragged over rocks.

General view of stringing operations.

Work is started by stringing the first length at the bottom of the hill. Should the hill be very steep the pipe is anchored in position with stakes, which may be easily removed. As each consecutive length is pulled up a stake is placed between the ends of the pipe as it is rolled into position.

The country frequently affords the construction crews an opportunity to operate the winch from an advantageous location in a valley, thus permitting the stringing operations on two inclines to be carried on from one spot. The tractor is usually set approximately level by running it on log tracks placed on the low side. A pulley block is anchored on the crown of the ridge and stringing follows in the manner described with either one or two lines.

By using this method the contractors are able to accelerate their stringing work and accomplish the job with a minimum of trouble.

Close-up of double drum winch on tractor.

Here's the Answer to the HOLLOW BALL Question

They are tested for balance by floating in mercury

For years manufacturers and users have tried to produce or purchase hollow steel balls suited to their individual requirements. The results were discouraging. We know because we faced the same problem.

But now we have the solution.

TRANSIT hollow steel balls are seamless, and contain no second metal welded into the joints. In other words each ball is a hollow sphere of but one kind of metal. The finished ball is nicely balanced because it is formed accurately and contains no welding icicles.

They are ground to size and tested for balance by floating them in mercury. There are no plugs to loosen and leak or to unbalance the ball. The result is a perfect ball.

If you are interested in the use of balls as valves or for any other service we would like to tell you more about this great advance in hollow ball making.

Please write us.

BEAUMONT, TEXAS
E. L. Wilson Hardware Company

SALT LAKE CITY, UTAH
F. C. Richmond Machinery Co.

NATIONAL TRANSIT
PUMP & MACHINE CO.
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Republic Supply Company of California

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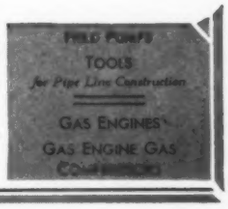
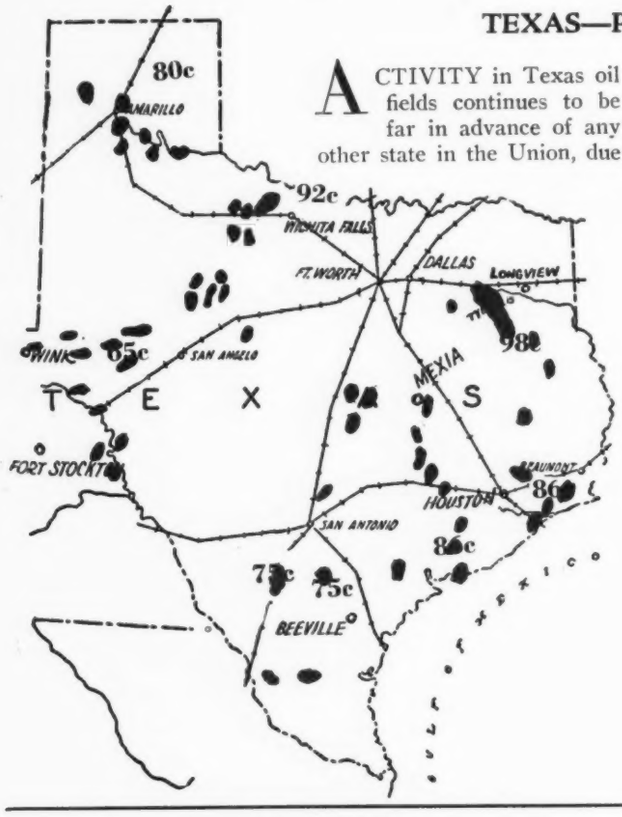
Reeves & Skinner Machinery Co.

NEW YORK PHILADELPHIA CLEVELAND PITTSBURGH LOS ANGELES HOUSTON TULSA NEW ORLEANS



Latest Activities *in the* Oil Fields*

TEXAS—Production, 1931—330,720,000 Barrels



ACTIVITY in Texas oil fields continues to be far in advance of any other state in the Union, due almost entirely to the East Texas area, where the mammoth drilling campaign continues in full sway.

The state had 713 drilling permits, 690 completions, 402 rigs and 787 drilling tests in April, which is an increase over the previous month, probably due to the approach of warmer and drier weather.

Following is a tabulated report of several fields in the state:

	POOLS		
	East Texas	Pan-handle	Van Field
Number of Permits	437	14	8
April Completions	451	10	11
Number of Rigs	227	12	2
Number Drilling Wells	427	39	9
Gravity of Oil	40	40	36
Depth of Production	3600	2900	2600
Type of Tools Used	Rotary	Rotary	Rotary
Number of Casing Strings	2	2	2

CALIFORNIA

Production, 1931—188,575,000 Barrels

There were 18 new drilling locations and 30 completed tests made in California during the month of April. The state at the close of the month had 15 rigs and 156 drilling tests.

A tabulated survey of a few of the more active fields in the state for the month of April follows:

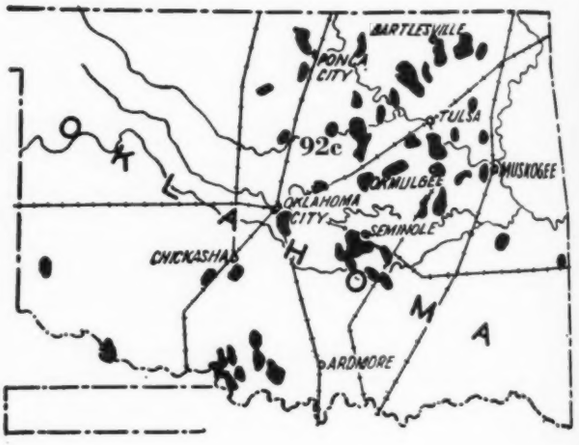
	POOLS			
	Playa Del Rey	Long Beach	Kettleman Hills	Ventura
Number of Permits	0	2	2	1
April Completions	2	5	0	2
Number of Rigs	0	2	2	3
Number Drilling Wells	1	20	13	5
Gravity of Oil	23	26	60	36
Depth of Production	6000	7000	8300	7800
Type of Tools Used	Rotary	Rotary	Rotary	Rotary

*All statistics as of May 1st.

● Denotes oil and gas fields.

OKLAHOMA

Production, 1931—177,750,000 Barrels



The number of drilling wells in this state for the second consecutive month showed a good-sized increase.

Following is a summary of Oklahoma's activity:

	Entire State	Oklahoma City
Number of Permits	126	22
April Completions	80	9
Number of Rigs	81	12
Number Drilling Wells	185	55
Gravity of Oil	36 (average)	39
Type of Tools Used	Rot.-Cab.	Rotary
Number of Casing Strings	Varies	3
Depth of Production	Varies	6500

Figures on maps indicate average prices of crude oil per bbl.

which *of these* BITS *drilled* 1,200 FEET?

Here are two bits from the same field at Tuxpan, Mexico. No. 1, plain hard-faced, drilled 700 ft. without redressing. No. 2, set with Haystellite and faced with Haystellite-Composite Rod,* made 1200 ft.

Haystellite and Composite Rod are revolutionizing drilling practice as completely today as plain hard-facing did several years ago. Setting and facing your tools with these two alloys insures a sharp tough cutting edge; greater footage per round trip; and lower cost per foot.

Haystellite-Composite Rod consists of sharp irregular particles of crushed Haystellite—a high-grade tungsten carbide—thoroughly mixed with a Haynes Stellite, Hascrome, or High Test steel binder. When the rod is melted, the Haystellite particles are evenly distributed on the cutting surface. The binder *seals* them in and protects them for long cutting life.

There is a Haystellite-Composite Rod for every purpose and for every type of tool and formation.

Our Engineers will be glad to demonstrate how Haystellite and Composite Rod can do for you what they are doing for drillers in East Texas and other fields.

**Patent applied for*

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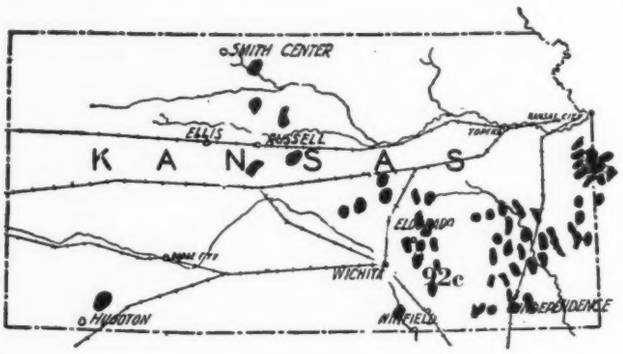
Haynes Stellite Welding Rods and information on other Haynes Stellite Products also are available through the 42 apparatus shipping points of The Linde Air Products Company

KANSAS—Production, 1931—37,950,000 Barrels



Kansas had 40 new drilling permits, 33 completions, 15 rigs and 76 drilling tests to show for its oil field activities during the month of April. Both rotary and cable tools are used in the state, with the latter predominating in number.

Following is a report of the activities in the three most active areas of the state:

	POOLS		
	Sedgwick County	McPherson County	Ellsworth Arch
Number of Permits	4	11	6
April Completions	7	10	4
Number of Rigs	1	9	2
Number Drilling Wells	9	28	15
Gravity of Oil	39	38	37
Depth of Production	2900-3500	2900-3400	3300
Type of Tools Used	Rot.-Cab.	Rot.-Cab.	Cable
Number of Casing Strings	2	2	4

ARKANSAS

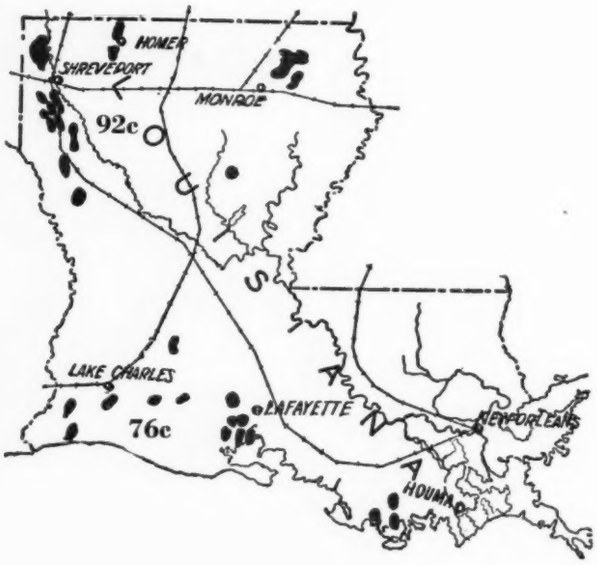
Production, 1931—15,425,000 Barrels

There were 5 locations, 3 completions, 8 rigs and 32 drilling tests carried on activity reports for the state of Arkansas during the month of April.

Rotary type tools are used by contractors for drilling purposes in the state, where formations frequently carry large gas pressures and are usually soft and cavey.

LOUISIANA

Production, 1931—22,325,000 Barrels



Louisiana had 37 new drilling permits, 30 completions, 22 rigs and 74 drilling wells for its oil field activities during the month of April. Rotary tools are operated in both the Gulf Coast and North Louisiana areas.

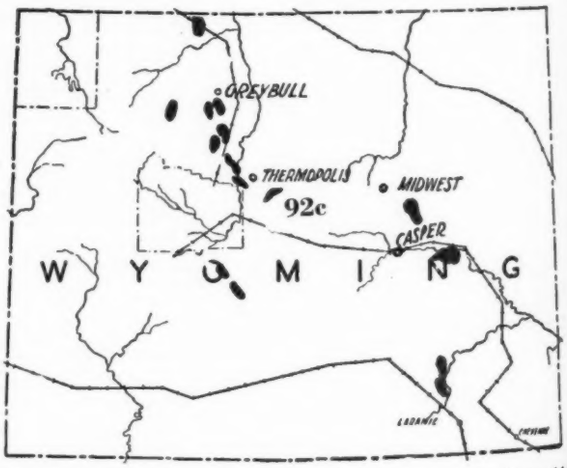
Mississippi, adjoining Louisiana to the east, had 9 completions, 7 rigs and 12 drilling tests during the month.

●Denotes oil and gas fields.

WYOMING

Production, 1931—14,725,000 Barrels

Wyoming had 2 completions, 11 rigs and 61 drilling tests during the month of April. Practically all the tests were cable tool installations.



Figures on maps indicate average prices of crude oil per bbl.

NEW YORK

Production, 1931—3,400,000 Barrels

PENNSYLVANIA

Production, 1931—11,225,000 Barrels

Pennsylvania had 51 completed tests last month, while 65 were active drilling operations and 24 were rigs.

In New York 9 tests were completed, 1 operation carried on scout reports as a rig and 7 tests were drilling.

ILLINOIS

Production, 1931—4,850,000 Barrels

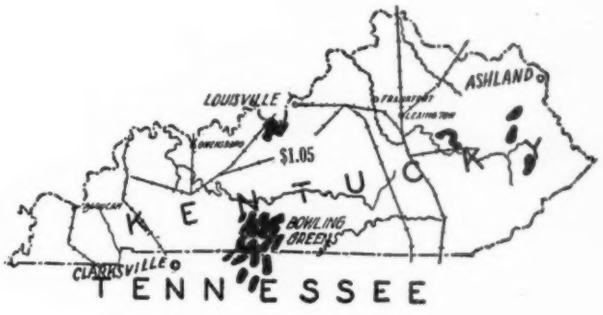
In Illinois there were only two oil tests completed during the month of April. Other oil field activity consisted of one rig and 20 drilling wells.

Standard tools are used by operators of the state for drilling purposes. The producing formations are shallow and easily reached.

KENTUCKY

Production, 1931—6,490,000 Barrels

The state of Kentucky had 30 completions, 8 rigs and 63 drilling tests last month. Tennessee had no completions or rigs and 14 drilling tests. Cable tools are used by operators of both states.



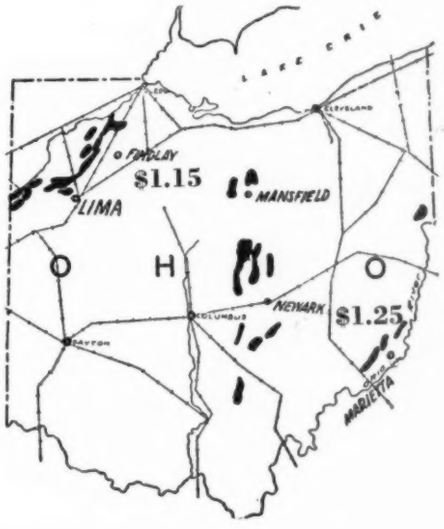
TENNESSEE

Production, 1931—8,000 Barrels

OHIO

Production, 1931—5,315,000 Barrels

Forty-eight completions were made in the state of Ohio during the month of April, at the close of which period 99 tests were drilling and 35 were rigged up. Cable tools are utilized for all drilling operations in the state, where producing horizons are comparatively shallow and upper formations do not offer hard penetration.



WEST VIRGINIA

Production, 1931—4,480,000 Barrels

West Virginia had a total of 15 completions last month. Other oil field activities were comprised of 21 rigs and 31 drilling tests. Standard tools are used for drilling purposes in the state.

Denotes oil and gas fields.

Figures on maps indicate average prices of crude oil per bbl

NEW MEXICO

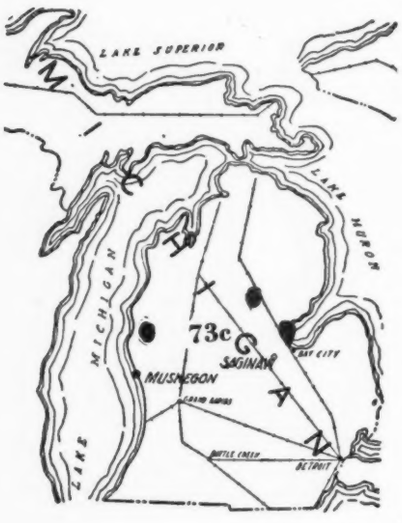
Production, 1931—15,250,000 Barrels

A total of but two tests were completed in New Mexico oil fields during the month of April. Active tests under way in the state consisted of 8 rigs and 42 drilling wells at the close of the month.

Both rotary and cable tools are used in the state, with the former outnumbering the standard tools. Rotaries are used primarily in the southeastern section of the state, in the general region surrounding the Hobbs pool, where producing horizons are 4,000 feet deep and where heavy pressure is frequently encountered in the upper formations.

MICHIGAN

Production, 1931—3,730,000 Barrels

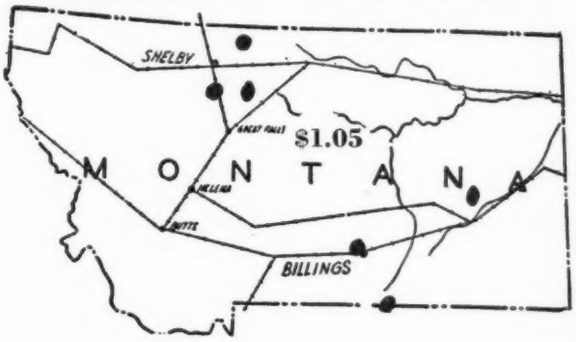


The state of Michigan had a total of 9 completions in April, while 80 tests were drilling and 51 were rigged up.

Operators of the state do their drilling with cable tools, except in a few instances where rotary tools have been used.

MONTANA

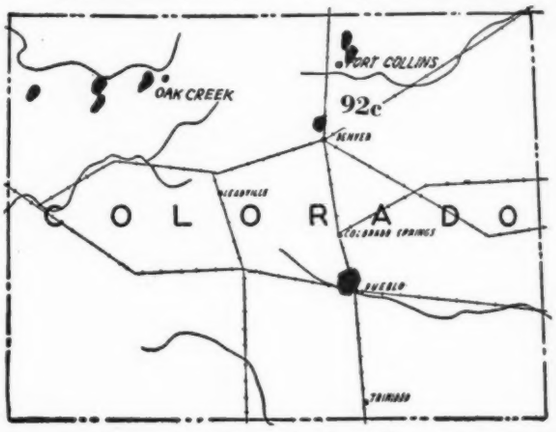
Production, 1931—2,855,000 Barrels



Only one well was completed in Montana during April. The state had 12 rigs and 50 drilling tests at the close of the monthly period. Cable tools are the most common means of making hole.

COLORADO

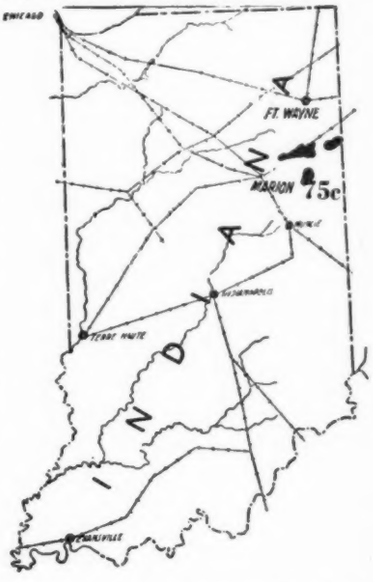
Production, 1931—1,510,000 Barrels



Two completions, 9 rigs and 67 drilling tests comprised Colorado's oil field operations last month. Both rotary and cable tools are used here.

INDIANA

Production, 1931—830,000 Barrels



There were a total of 3 completions in Indiana oil fields during the month of May. Tests under way totaled 58, while two were listed on activity reports as rigs.

Drilling operations in the state are conducted with standard type tools.

● Denotes oil and gas fields.

Figures on maps indicate average prices of crude oil per bbl.

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Leschen Wire Line

for

Every Oil Field Purpose

In order for a Wire Line to give maximum service it must be of the right quality and the right construction to fit the particular conditions under which it is to work. Just any wire rope won't do.

Our long experience in the Oil Fields has made it possible for us to know the needs of this Industry, and our research work and our manufacturing facilities have enabled us to develop a correct type of Leschen Wire Line for every condition.

Moreover, all Leschen Steel Wire Lines are made of acid open-hearth steel wire, and every wire is first rigidly tested by us to make sure that it comes up to our established standards and requirements.

You experienced Oil Men know that your operating costs depend a whole lot on the kind of service you get from your wire lines, so why not play safe by using Leschen Lines—they have proved in actual Oil Country work that they are dependable and economical.

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Progress of Major Pipe Line Work

By J. H. DAMERON

PROSPECTS for the construction of considerable mileage of pipe lines this summer appear brighter at present than at any time this year, although, just now, only one major project is getting under way. The Southern Counties Gas Co., Los Angeles, Calif., is completing final plans for the construction of a line running from Long Beach to supply San Diego. Pipe has been purchased for the project.

The line will terminate at La Jolla, where it will tie into the San Diego Consolidated Gas & Electric Co. system. The Southern Counties Co. will build 68 miles of 12-inch from Long Beach and 10½ miles of 16-inch to Huntington Beach. The San Diego utility company will build 7 miles of line on in to San Diego. The entire project will represent an investment of approximately $1,700,000.

Numerous projects in the northern areas appear to be making good headway and several of the companies have already started their lateral line construction. Throughout the Mid-Continent several oil and gas transporters are already engaged in repair jobs scattered along their systems.

One of the most interesting of the newer developments is the proposal of James F. Sadler, Los Angeles, Calif., who plans to build a 640-mile, 12-inch oil line from West Texas over mountainous country to the port of Topolobampo, in the state of Sinaloa, Mexico. The port is on the Gulf of California.

Present plans call for the construction of two refineries, one at Chihuahua to enter the domestic markets in that area and the other at the seaport, where the company plans to enter the Mexican Pacific Coast markets and export. Crude goes into Mexico duty free, but a duty is imposed on imported refined products.

The entire project is estimated to cost somewhere in the vicinity of $18,000,000. The promoters stated the financing of the project was virtually complete. In addition to the oil, the company plans the construction of a natural gas line to extend as far as Chihuahua to deliver industrial loads to ore smelters.

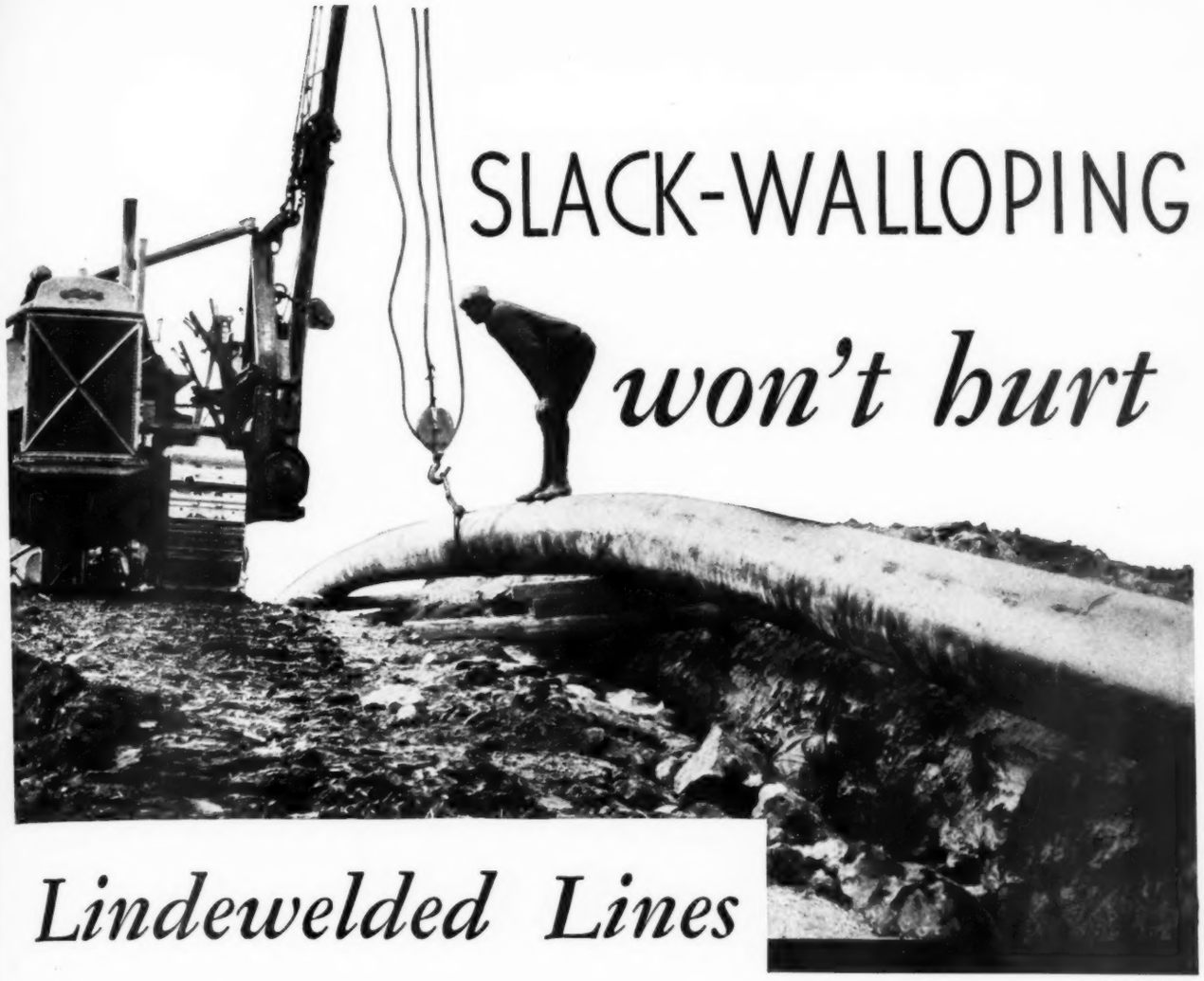
Tentative station design for the oil line would give it a daily pumping capacity of about 40,000 barrels. It is estimated this line will cost about $30,000 per mile to lay, because a large portion of the proposed route would carry it over mountain ranges. Surveys are being made at the present time, according to the promoters, and, should such a line be built, it will place West Texas crude into direct competition with California crude.

Another proposed oil line is the San Juan Pipe Line Co., Los Angeles, Calif., project, running from the Four States field in the southeastern corner of San Juan County, Utah, to Farmington, N. M. It is proposed to deliver crude from the field to the Continental Oil Co.'s Farmington refinery. It is stated that approximately 35 miles of the proposed 92-mile right-of-way remains to be surveyed. According to reports from the West Coast, construction work will be started when the weather permits. Present plans call for the construction of three stations to operate the carrier.

Reports have been revived that the Panhandle Eastern Pipe Line Co., Kansas City, Mo., and the Columbia Gas & Electric Co., which owns half interest in the former, will build a natural gas line into Detroit, Mich. Such a line would tie into the Panhandle Eastern line at Rockville, on the Illinois-Indiana border, extend northeast to Detroit, and pass through an area spotted with good-sized towns.

Most of the gas line construction this summer will perhaps be centered in the north central part of the United States. Interests working on proposals to build lines out of the Montana and Wyoming fields have revived negotiations with cities both east and west of those areas. Some of these proposals are sponsored by power companies operating in those sections and the other proposals are being pushed by various groups of individuals.

Both of the Mid-Continent's major gasoline transporters are considering starting work in the near future to increase their pumping capacity. One of the companies has increased capacity during the past few months by building booster stations and has little more work left to finish. The other transporter is considering adding substantial capacity to its line by building several booster stations along sections of its system.



SLACK-WALLOPING *won't hurt*

Lindewelded Lines

A TEXAS pipe line company subjected a 2,000-ft. test section of 24-in. Lindewelded line to severe bending strains by "slack-walloping" it on skids over a 64-in. trench. The line was allowed to expand and contract with changing temperatures. Not a joint failed. Lindewelding insures strength.

It saves money, too:

Lindewelding takes 30 to 60 per cent. less time than other methods and requires 30 to 40 per cent. less welding material. It is not a new kind of welding; it is a new way to do oxy-acetylene welding. It can be done with ordinary blowpipes or with special apparatus which makes welding almost automatic and further increases its speed. Experienced welders quickly master Lindewelding technique; beginners learn it more readily than other methods.

Procedure controls for this cost-cutting method of oxy-acetylene welding are available to all Linde customers as a part of Linde Process Service. Any Linde District Office will be glad to give you complete information.

Motion Picture Shows details of Lindewelding

Lindewelding technique differs from neutral-flame welding technique in that it employs a special rod, a special flame adjustment, and the "backhand" method of blowpipe manipulation. The actual steps in making a Lindewelded joint are shown in our motion picture, "The Lindeweld Process for Pipe Line Construction". This picture will be loaned free of charge to pipe line officials and welding or engineering societies. It is furnished in 16 mm. and 35 mm. safety film and can be obtained by writing to any Linde District Office.

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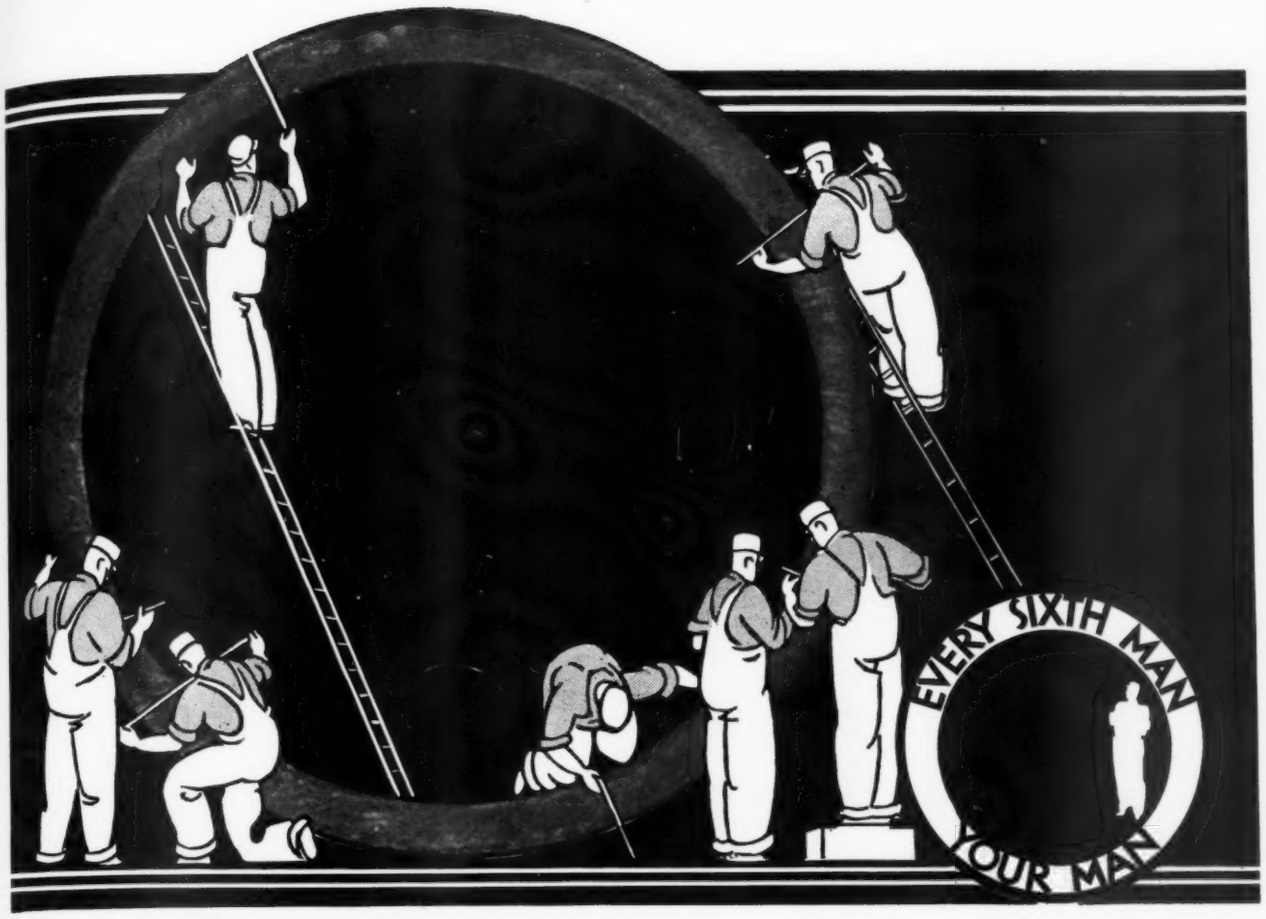
PIPE LINES UNDER CONSTRUCTION AND CONTEMPLATED

Type Line	Company Name	Headquarters	Point of Origin	Terminal	Size Pipe	Length in Miles	Remarks
Ga.L.	Atlantic Refg. Co.	Philadelphia, Pa.	Point Breeze	Wilkes-Barre, Pittsburgh	6-8"	475	Part of system operating. Plan extension of main line this year.
G. L.	Bivens, C. E., et al.	Laramie, Wyo.	Baggs Field	Laramie, Wyo.	12"	104	Plan to build in 1932.
G. L.	Big Bend Pipe Line Co.	Ft. Stockton, Tex.	(See Remarks)				Plan to extend present system with 60 miles of 4-inch.
G. L.	Columbia Gas & Elec. Co.	New York, N. Y.	Ky. or Pan Eastern Line	Detroit, Mich.	20"	220	Considering going to Detroit, Mich., with line and to Toledo.
G. L.	Continental Constr. Corp.	Chicago, Ill.	Chicago, Ill.	Detroit, Mich.	20"	200	Plan extension of Panhandle line to Detroit.
G. L.	Continental Constr. Corp.	Chicago, Ill.	Point in Ill.	Milwaukee, Wis.	20"	160	Under advisement.
G. L.	Continental Constr. Corp.	Chicago, Ill.	Texas Panhandle	Chicago, Ill.	24"	1000	Plan to start parallel present line in 1932.
G. L.	Cities Service, Insull, Texas Corp. & S. O. N. J.	(See Remarks)					Rumored considering building 1,500-mile project from Panhandle to Eastern cities.
Ga.L.	Great Lake Pipe Line Co.	Kansas City, Mo.	Okla. Midcontinent	Great Lakes Region	4-6-8"	1440	Considering increasing station capacity this spring.
G. L.	Great Northern Gas & Utilities Co.	Minneapolis, Minn.	(See Remarks)				Planning gas line from Baker-Glendive area in Montana to Minneapolis and St. Paul.
G. L.	Hutcherson Pipe Line & Gas Co.	McPherson, Kan.	(See Remarks)				To build short line from Ritz-Canton area in McPherson County, Kan., to McPherson.
G. L.	International Util. Corp.	New York, N. Y.	Alberta, Canada	Vancouver, B. C.	20"	500	Proposed.
G. L.	Kentucky Public Service Co.	(See Remarks)					Posted bond to build short line from Hart County, Ky., to Bardstown, Ky.
G. L.	Jerome Drumheller	Spokane, Wash.	Cut Bank, Wyo.	Seattle, Wash.	20"	500	Proposed.
G. L.	Lycoming Nat. Gas. Corp.	New York, N. Y.	Tioga Field, N. Y.	Syracuse, N. Y.			Plan to extend main line from Syracuse to Oswego with 38 miles of 16-inch.
G. L.	Lewiston Nat. Gas Co.	Lewiston, Mont.	Armells Structure, Mont.	Mont. towns	4-6"	100	Proposed.
G. L.	Mid-Continent Public Service Co.	Fort Scott, Kan.	Field near Chanute	Fort Scott	8"	28	Moore-Creekmore Const. Co., Tulsa, have contract to build upon completion of plans.
G. L.	Missouri Valley P. L. Co.	Omaha, Neb.	Point in Minnesota	Minneapolis, Minn.	16"		Proposed along with extension work in Iowa.
G. L.	Montana-Dakota Power Co.	Minneapolis, Minn.	Williams, N. D.	Minot, N. D.	12"	100	Applied to N. D. Commission for permission to build.
G. L.	Mo.-Kans. Pipe Line Co.	Chicago, Ill.	Russellville, Ky.	Nashville, Tenn.	10"	50	Proposed.
G. L.	North Central Gas Co.	Casper, Wyo.	(See Remarks)				Reported planning 100 miles of extension work in Nebraska and near-by territory.
O. L.	Old Dutch Refining Co.	Muskegon, Mich.	East Michigan Fields	Muskegon	4"	100	Considering building.
G. L.	Ohio Oil Company	Findlay, Ohio	Weiser Field, Idaho	Boise and Northwest area			Filed application for conveyance certificate.
G. L.	Pacific Gas & Elec. Co.	San Francisco, Calif.					Have appro. for $2,000,000 expansion campaign. Building 45 miles of 26-in.
G. L.	Panhandle Eastern P. L. Co.	Kansas City, Mo.	(See Remarks)				Building 25 mile 8-in. line from Hannibal, Mo., to Quincy, Ill.
O. L.	Presidio Petroleum Co., Ltd.	Los Angeles, Calif.	Midland, Tex.	Topolobampo	10"	640	Propose to build to Mexican Port and erect two refineries, one at Chihuahua for domestic trade and the other at tidewater for export trade. Plan to parallel oil line with gas line to Chihuahua. J. F. Sadler promoting.
O. L.	San Juan Pipe Line Co.	Los Angeles, Calif.	San Juan County, Utah	Farmington, N. M.	8"	92	Reported planning to build this summer. Line will have three stations.
Ga.L.	Sun Pipe Line Company	Philadelphia, Pa.	Point in N. Y.	Lake Ontario	6"	45	Extending to tidewater terminal.
G. L.	Southern Counties Gas Co.	Los Angeles, Calif.	Huntington Beach	La Jolla	12"	68	To supply gas to San Diego. Construction to start June 1. Line will be welded.
G. L.	Southern Nat. Gas Corp.	Birmingham, Ala.	(See Remarks)				Reported planning extension to Chattanooga, Tenn.
G. L.	St. Louis Industrial Fuel Co.	St. Louis, Mo.	(See Remarks)				Plan to enter St. Louis for industrial loads with line from southwest.
O. L.	Texas Empire Pipe Line Co.	Tulsa, Okla.	Okla. City, Okla.	East Texas	10-12"	250	Project held in abeyance.
G. L.	Wasatch Gas Company	Ogden, Utah	Ogden, Utah	Pocatello, Idaho	10"	140	Applied for permit to build welded line.

TABLE

O. L.—oil line Ga. L.—gasoline line
G. L.—gas line



STRENGTH REQUIRES IT . . . J & L SEAMLESS HAS IT . . . UNIFORM WALL THICKNESS

EVERY FOOT OF ITS LENGTH

Every joint of J & L Seamless Pipe that comes to you has been carefully gauged at both ends for concentricity. Inspectors, on our payroll but working for you, have checked it with precision limit gauges. Every sixth man in the Seamless Tube Department is an inspector, and each inspector checks the inspections that have gone before. Accidental damage to some portion of pipe already inspected cannot go by undetected. Failure of the pipe to meet exacting standards means rejection.

As a consequence, J & L Seamless Pipe offers uniform resistance to water pressure collapsing strains, and uniform strength for resisting pulling-out stresses. Always dependable, it provides the physical properties that field practice demands.

CASING DRILL PIPE · TUBING LINE PIPE · J&L PIPE · SEAMLESS · WELDED

JONES & LAUGHLIN STEEL CORPORATION

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JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

J&L STEEL

Manufacturers of Seamless and Welded Casing, Tubing, Drill Pipe and Line Pipe, and Welded Steam, Gas and Water Pipe in both Black and Galvanized

Also makers of Bars, Shapes and Plates, Reinforcing Bars, Cold Finished Steel, Junior Beams, Steel Piling, Fabricated Structural Work, Steel Barges, Wire Products and Tin Mill Products

The Month's Activities *in* Refining*

By F. R. STALEY

THE Ethyl Gasoline Corporation carried on one of the most extensive advertising campaigns in its history during the first week of May for the purpose of announcing a new and higher standard for Ethyl Gasoline and to emphasize Ethyl's universal distribution.

The Indian Refining Company is constructing two cracking units of 1,500 barrels capacity each at Lawrenceville, Ill.

The Texas Pacific Coal & Oil Company is now operating a newly constructed skimming unit at the Fort Worth refinery. The operation is in connection with a Cross cracking unit.

A new refinery will be constructed at La Plata, Argentina, by the Argentine Government to manufacture lubricating oils, greases, paraffine and asphalt.

Refinery construction in France is being carried out almost entirely by the French Government, and, it is planned, will be finished in 1933.

The Associated Oil Company's research department has developed a new use for spent contact filtering clay. A small percentage of the clay will greatly improve Portland cement. One of the largest cement companies on the Pacific Coast has adopted the method.

Many interesting technical papers were presented before the Western Petroleum Refiners Association at their twentieth annual meeting, Excelsior Springs, Mo. A set of gasoline specifications proposed for the association was presented by H. W. Camp. They cover three grades of gasoline: Under 57 octane; 57 to 65 octane; and 65 octane and above. The specifications were made as complete as possible in order to meet the requirements of sales departments and the general public.

The petroleum group presented a number of papers of importance to refinery technologists at the regional meeting in St. Louis of the American Chemical Society.

A viscosity-temperature chart has been adopted as a tentative standard by the American Society for Testing Materials. It was prepared by Committee D-2 on Petroleum Products and Lubricants. The chart is useful in the solution of problems involving oil performance under varying temperature conditions.

The annual summary of injuries in the petroleum industry issued by the American Petroleum Institute shows that the frequency of accidents has been reduced 54 per cent in the last five years, since 1927, and 21 per cent since 1930. The severity of accidents has been reduced 22 per cent since 1927, and 13 per cent since 1930.

A reduction in the royalty rate for viscosity breaking by the Dubbs cracking process has been announced. No royalty will be charged for the straight-run gasoline content of the crude oil run to Dubbs units providing this gasoline is not subjected to cracking conditons.

Natural Gasoline

A sales company has been formed in Mexico City to distribute liquefied petroleum gas to various cities in Mexico. The fuel will be shipped from Los Angeles, Calif.

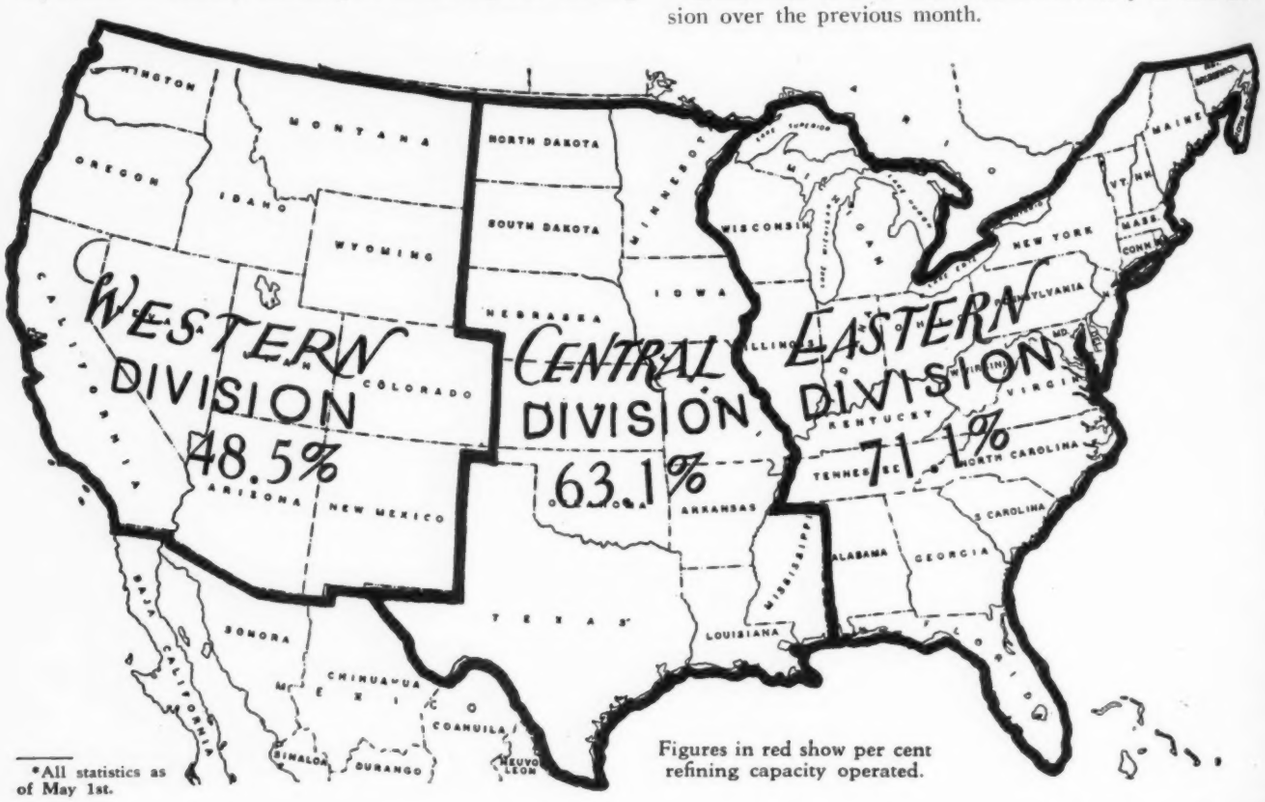
A 15-ton dry ice plant will be built on the Santa Fe Railroad in New Mexico near the Wilcox Dome.

Much interest has been shown to continuous recondition of absorption by distillation. A number of plants are using the operation with fine success.

The ninth annual Southwestern Gas Measurement Short Course was held at the University of Oklahoma April 26, 27 and 28.

The Natural Gas Corporation of California recently completed the largest air-butane plant on the Pacific Coast at El Centro. The capacity is 60,000 cubic feet per hour.

Crude runs to stills increased considerably in each division over the previous month.



Figures in red show per cent refining capacity operated.

*All statistics as of May 1st.

STAINLESS AND HEAT RESISTING PIPE AND TUBES

U S S Chromium-Nickel Alloy Steels are produced under the licenses of the Chemical Foundation, Inc., New York; and Fried. Krupp A. G. of Germany.

For certain uses in the Refining Industry, tubing materials of quite special properties are required. High resistance to corrosion and improved strength at high temperatures are indispensable; but they must be secured in combination with other qualities found only in high-grade steels. NATIONAL U S S Stainless and Heat Resisting Pipe and Tubes have been developed to meet such needs. They are now available with variations of character corresponding to formulas that long research has proved most useful. The same care and thoroughness which have always gone into NATIONAL products for the uncompromising demands of the Refining Industry are fully applied to this superior material. NATIONAL engineers and technicians are at your service for any assistance they can offer in the application of corrosion and heat resisting pipe and tubes for your purpose. Ask for informative booklet—"NATIONAL U S S Stainless and Heat Resisting Pipe and Tubes".

NATIONAL TUBE COMPANY - Pittsburgh, Pa.

Subsidiary of United States Steel Corporation

Liners With Cement Lining Reduce Washing-in Hazards *at* Wells

IN fields of relatively low rock pressure due care has to be exercised in drilling in with rotary tools, and precautions taken to obviate mudding the face of the oil sand. Drilling in with oil as a drilling fluid has been resorted to in certain wells in some fields where this is likely to occur. If the rock pressure is great enough, a well will usually clean itself without difficulty. However, where the bottom-hole pressure is lower than the hydrostatic pressure exerted by a column of water equal in length to the depth of the well, and heavy mud is used for drilling, it is of extreme importance to wash the face of the sand thoroughly free of mud, cavings and cuttings when bringing the well in. If this is not done, there is always danger that the capacity of the well to produce will be seriously impaired.

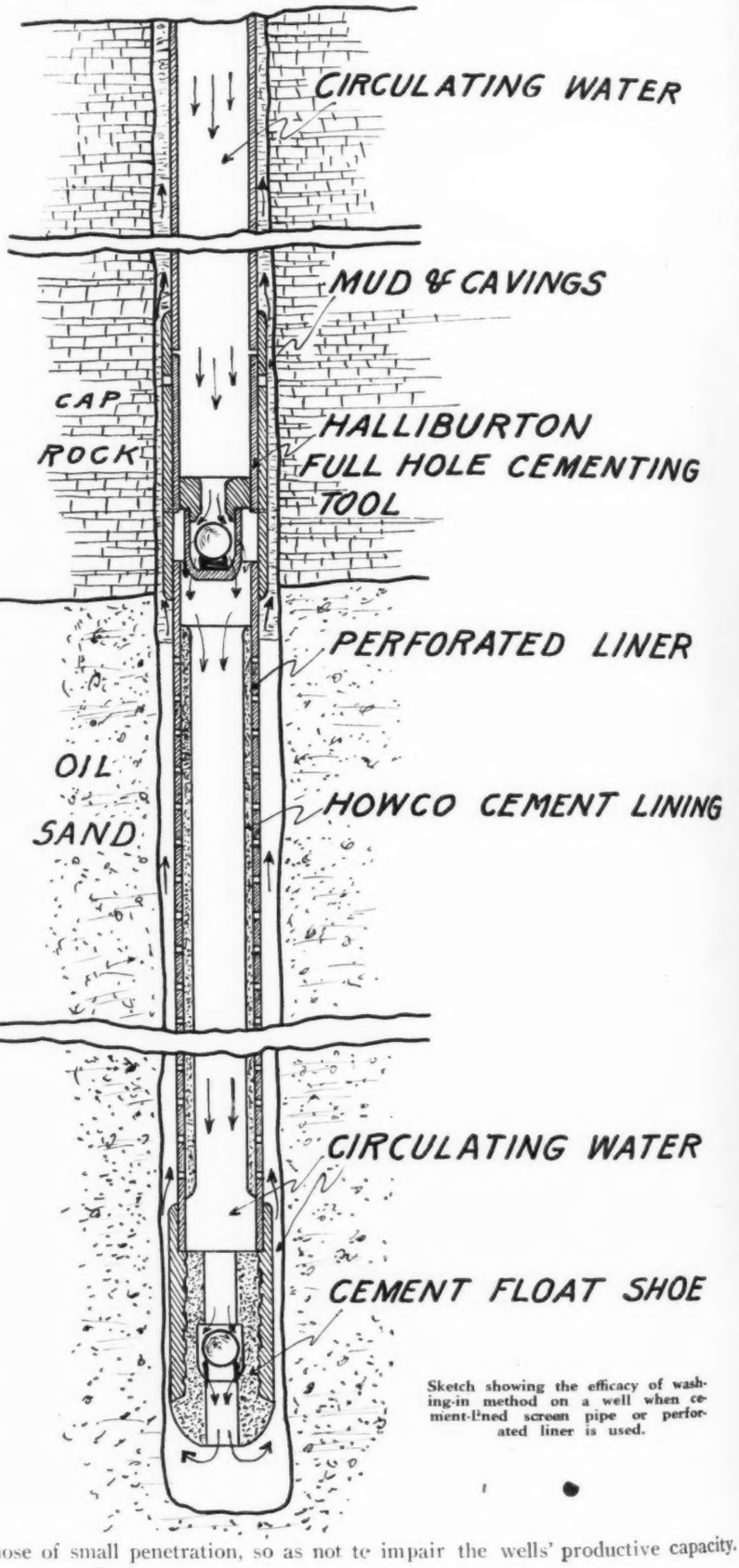
A recent improvement in cementing equipment designed to overcome this difficulty is in use by several companies in the East Texas field. It is the Howco Cement Lining for use with perforated or screen pipe, and is commonly used in conjunction with the Halliburton Full Hole Cementer.

As can be seen from the accompanying sketch, the use of the special cement lining covering the perforations as indicated accomplishes the flushing of the space between the sand face and perforations in a thorough and positive manner, and makes of it a simple operation. By following up the water with cement the complete job of washing the sand face and cementing the well virtually is done in a single operation.

When the cement has set, the cement lining is easily drilled out with the cementing plugs and float shoe, and washed out of the hole. A special method of applying the cement to the inside of the liner, and the material composing the liner permits it to be drilled out freely, without any of the cement adhering to the liner.

Operators in East Texas now using this method of washing and cementing their wells assert that it is positive and economical, and practically eliminates the hazard of partially mudding off the face of the sand.

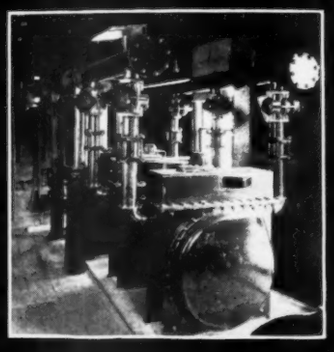
As to the effect on the possible productive capacity over the total life of the well, penetration and diameter of hole in the pay sand are now being given some study in the East Texas field, especially in those areas on the west edge where the penetration of the sand is limited on account of the proximity of bottom or edge water. A large-diameter hole with minimum penetration might be most desirable in these wells in order that water encroachment be deferred to as late a period as possible in the producing life of such wells. It would seem that operators in the East Texas field are cognizant of this condition and possibility, and are adopting every precaution necessary in washing in their wells, especially those of small penetration, so as not to impair the wells' productive capacity.



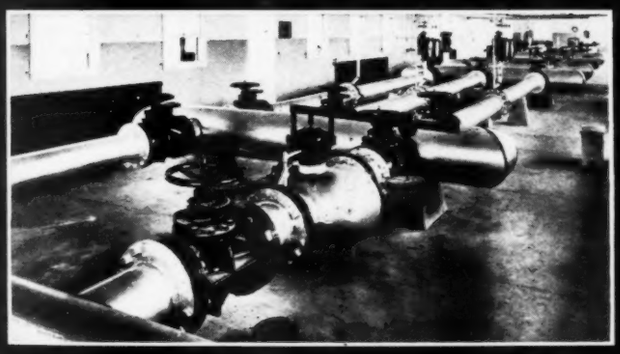
Sketch showing the efficacy of washing-in method on a well when cement-lined screen pipe or perforated liner is used.

Announcing an Association of Interests

MERCO NORDSTROM VALVE CO.
PITTSBURGH EQUITABLE METER CO.



EMCO-MERCO
IN IOWA



EMCO-MERCO
IN UTAH

NORDSTROM VALVES

MERCO

Many Interesting Problems Discussed at Gasoline Plant Operators Meeting

• ● •

A natural gasoline plant in Kettleman Hills, California.

VAPOR pressure is the most important single factor in the manufacturing, blending, and shipping of natural gasoline, and is the sole guide for keeping plant production up, and at the same time, not exceeding the specified vapor pressure of the particular product to be shipped. The man who runs vapor pressures must realize he is handling an expensive piece of laboratory equipment. Slighting some seemingly trivial point might affect the final result from 0.5 to 3.0 pounds. These facts were recently stated by Warren Felton, Phillips Petroleum Company, to a group of natural gasoline plant operating men at Ranger, Texas.

Mr. Felton further stated that there are five chief sources of error in vapor pressure determinations as follows:

1. Evaporation of the sample
2. Dissolved air in the sample
3. Air present in the apparatus
4. The spring gauge error
5. Personal errors

The Phillips Petroleum Company found that it would be necessary to take the A. S. T. M. procedure, and without changing or affecting the method at all, insert specific interpretations and definite instructions so that all men concerned would be running these tests exactly alike at all plants. Some of these are:

1. The ratio of the volume of the air chamber to the volume of the gasoline chamber is exactly four. The limits of 3.8 to 4.2 are allowed in the procedure but in order to place the ratio in the center of the tolerance all bombs are made exactly four to one.

2. Each bomb passes a test for leaks at 100 pounds per square inch gauge pressure before leaving the factory. This insures against vapor and liquid leaks, also some imperceptible leaks which might later develop.

3. The ¼-inch adapter for pressure gauge connection is attached premanently to the pressure gauge. In removing the gauge no pressure is brought to bear but a wrench of suitable size attached to a bench or other fixed position is applied to the hexagon shoulder of the ¼-inch adapter and the gauge and the adapter are removed as a unit.

4. Extreme care is used in determining whether gauges are accurate by the use of a mercury column for testing products up to 30 pounds per square inch absolute; for products over 30 pounds a dead weight tester is used.

5. End or smooth jawed wrenches are used to tighten joints to prevent leaks, if it is not possible to do so by hand.

6. Extreme care is taken to see that the air chamber is thoroughly purged of any gasoline or vapors remaining from a previous test. This is accomplished by using hot water (90-100 F.) from a faucet or the water from the bath if it is siphoned from below the surface of the bath into the air bomb. Care must be taken to prevent any gasoline on the surface of the water from entering this chamber.

7. In carrying the bombs to the loading rack, etc., it is more convenient to carry the air and gasoline chambers screwed together. Ordinarily there are no provisions for purging the bombs at the source of the sample. It is necessary then to purge the liquid bombs with hot water the same as the air bomb. The thorough rinsing with the product to be tested will work out all water. This is accomplished by inverting the California type gasoline chamber and allowing any small amount of water to drain out with the gasoline; the water from the standard type may be removed by several rinsings, if necessary.

8. The liquid chamber is filled completely to the top of the threaded neck and the air chamber should be attached immediately at the point of drawing the sample. If this is not done, evaporation and spilling of contents may occur which have been found to give lower results.

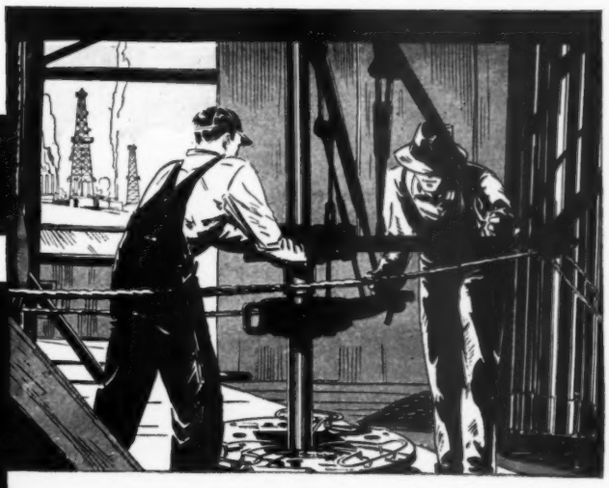
9. The ¼-inch needle valve attached to the gasoline bomb of the California type with pressure on the upper side of the needle should have a ¼-inch cap or other stoppage screwed on immediately after drawing sample to insure further against leaking.

10. The temperature of the air bomb shall be taken with a thermometer inserted into the bomb to such a distance that it shall balance on the ½-inch nipple.

11. A good joint seal other than shellac should be used on the threaded connections; key paste with a graphitic base and soap have both been found satisfactory.

12. In many cases the bomb is not shaken vigorously, and in order to clarify this particular point the definite instructions as interpreted by the Phillips Petroleum Com-

THE OIL WORLD'S STANDARD



in the jungles of Borneo, BJ Tools are always favorites.

The great oil fields of Russia are being developed with BJ Tools.

BJ Tools, taken apart and carried on coolies' heads in India.

To native crews in South America "BJ" means safe and easy to use.

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pany states: After five minutes the bomb is withdrawn from the bath, inverted (gauge down) shaken vigorously five times up and down and replaced in the bath.

13. With the proper care and attention to detail, duplicate results obtainable for vapor pressure values should not differ from each other by more than 0.3 pounds. The A. S. T. M. allows 0.5 pounds tolerance but it is believed that 0.3 pounds will call for more care and accuracy in conducting the test.

14. It is suggested to anyone interested that the foregoing inserts and changes be actually correlated in the procedure in their places to make them more valuable to the operator.

This definite information added and inserted in the official I. C. C. regulations for testing of gasoline by the vapor pressure method tends to secure uniformity of results by offering more definite descriptions of various phases of the test and should result in a standard technique of operation at all of the plants of the Phillips Petroleum Company.

The technical committee of the Natural Gasoline Association of America would welcome information regarding any discrepancy in results obtained by use of the standard procedure. It is very important that the procedure is carefully followed. Some sales managers claim that the vapor pressure of certain grades increases in shipment. Check tests run at six plants of the Phillips Petroleum Company did not vary more than 0.15 pounds.

Operation and Maintenance of Tank Cars

J. C. Carrothers, Lone Star Gasoline Company, emphasizes the fact that tank cars should be kept in the best of mechanical condition. They are often given some very rough handling in service. The safety valve setting and its mechanical condition is very important on cars used to transport natural gasoline. Before loading the car the bottom valve should be carefully inspected.

Proper safety precautions should be taken when inspecting the car before it is loaded. Frequently the atmosphere of the car consists of an explosive mixture of air and vapors that might be readily ignited by a spark caused by a nail in the inspector's shoe. A flashlight properly protected should be used, and the man should wear a mask inside the car. The car should be properly loaded so that it can be unloaded at its destination without any difficulty. Accidents have occurred in refineries were natural gasoline was being unloaded, and investigation showed the cause was due to carelessness in loading.

Economy in Automobile Operation

F. L. Richardson, Lone Star Gasoline Company, classified automobile and truck operating expenses as necessary and unnecessary. The problem is to determine what part is necessary. Nothing can be done about the necessary expense. The driver of the car is the most important factor in the control of car operating expense. The rate of depreciation will depend largely upon the operator of the car.

Operating costs are based on miles. Every possible mile of service built into a car should be obtained from it. The following factors must be considered in order to eliminate unnecessary expense:

1. Keep the car tight and in sound condition. Loose parts must be replaced frequently due to rapid wear.
2. Proper lubrication of an automobile or truck is very important, and must be given proper attention.
3. Good sense in driving, because careless driving usually causes unnecessary expense.

Most drivers are not mechanics, and consequently the practice of telling the garage mechanic what to do often causes unnecessary expense since he might be given the wrong instruction. He should be told what the trouble is, and determine the cause himself.

Carrothers pointed out that one of the largest fields for safety is in car driving. Safe driving has the following results:

1. It prevents the loss of human life and injury.
2. It creates good will for the company employing the driver.
3. It reduces unnecessary expense even when insurance is carried.

Whenever an accident report is made out the other fellow is always blamed, however, investigations show that about 90 per cent of the blame can always be placed on the driver.

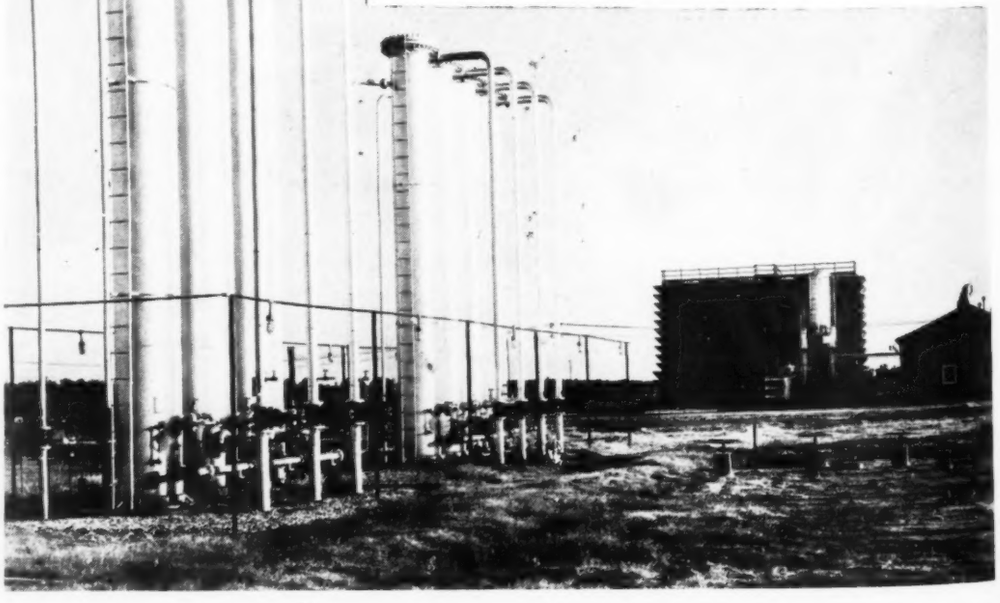
Water Treatment

A chemical treating method for plant water using trisodium phosphate and soda ash was described by D. B. Hiatt, Texas Pacific Coal and Oil Co. The method is simple and effective. The treatment settles suspended matter and reduces hardness and corrosion.

Reconditioning Still

H. C. Webb, Hanlon Gasoline Company, described a method of reconditioning absorption oil by the use of a shell still using fire and steam in the distillation.

Dr. E. R. Lederer and J. R. Jarvis presided over the sessions at Ranger for the discussion of plant operating problems. The importance of new ideas and constructive thinking by the operating men engaged in the natural gasoline industry was stressed.



High pressure absorbers on gas line in Louisiana.

Chemical Specialties *for the* Grease Plant

S. J. CAPLAN, *Chemical Engineer*

THE standard equipment of the ordinary grease plant is well suited for manufacturing a group of chemical products that is used by all automobile owners or auto mechanics. These products are usually marketed through garage dealers or jobbers catering to the garage dealers and for this reason can be sold by the grease salesman who is calling on the garage trade.

These items are commonly sold in small size containers so that the work of packing can easily be done by hand. Inexpensive mechanical devices for filling can be made in the plant, if the demand is great enough.

One of the products which is mentioned is seasonable. The rest are "year around" necessities. Most of them have petroleum bases, so that the average grease plant will have on hand a number of the raw materials required for making these automobile specialties.

Automobile Polish

30 gallons water
30 gallons Sulphonated Castor (75%)
40 gallons 28° Pale Paraffin oil (100 vis. at 100°F.)
Sufficient Amyl Acetate to give slight odor

Mix in the order mentioned. The resulting compound is a semi-permanent creamy emulsion. Directions should state "Shake Well Before Using".

Metal Polish

20 gallons Cleaners' and Dyers' Naphtha
70 pounds Foam Silica
1 gallon Red Oil
½ gallon 26° NH_4OH
¼ ounce Rhodamine B (oil soluble dye)

Mix in the order mentioned. Stir until perfectly smooth. This metal polish is one of the few that does not settle out silica.

Tire Cover Compound (Black)

50 gallons Alcohol
300 pounds H Rosin
25 pounds Spirit black nigrosine

The alcohol is placed in a mixing kettle. The paddles are started. The rosin is added slowly (2 hours). The paddles are kept going for about six to eight hours when it will be found that the rosin has gone into solution completely. The dye is then added and the batch allowed to stand, without agitation, over night.

Leather Dressing Soap

150 pounds 88% soap chips (Titre (39°)
344 pounds H_2O
1 pound Oil of Mirbane

The soap is dissolved in hot water and then allowed to cool until it starts thickening. The mirbane is then added and the batch run into appropriate containers. (To color black, add 6½ pounds lamp black.)

Auto Spring Oil

10 gallons Sperm Oil
30 gallons 28 Pale Paraffin Oil (100 vis. at 100° F.)
50 gallons Kerosene
10 gallons Cleaners' and Dyers' Naphtha
8 pounds Amorphous Graphite
8 pounds Oil of Eucalyptus

Mix in the order mentioned. Stir while running into packages. Mark "Stir Well Before Using".

Valve Grinding Compound

50% No. 2 Cup Grease
50% Carborundum (fine or coarse)

Mix in the cold.

Radiator Cement

250 pounds Gum Caoutchouc
240 pounds Denatured Alcohol
1040 pounds Hot H_2O
80 pounds Finely Powdered Asbestos

Dissolve in the order mentioned.

Anti-Freeze

70% Glycerine
30% H_2O

Stir thoroughly in steam-jacketed kettle. Mixture should be heated to 125°-150° F. This product is the equal of the best glycerine anti-freeze solutions on the market.

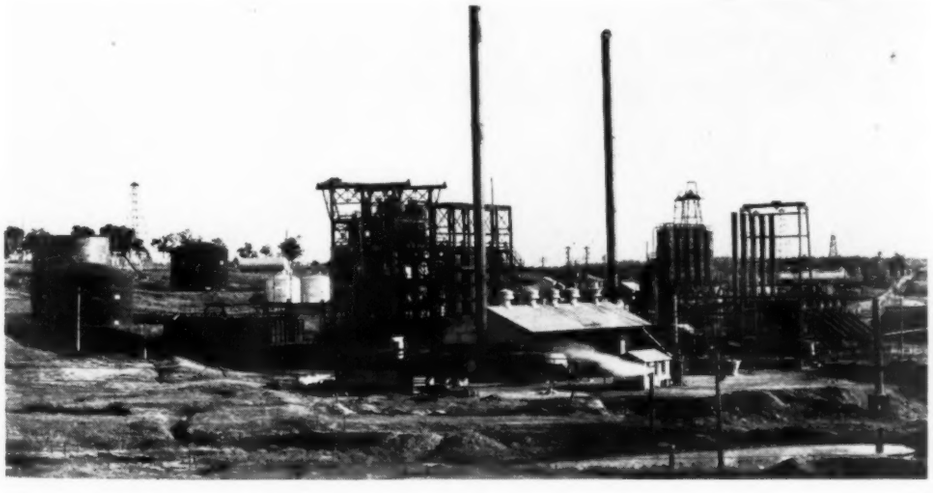
Mechanics' Hand Soap

40 pounds 88% Soap Chips (Titre 39°)
160 pounds H_2O
280 pounds Fine Sand or Pumice
8¾ pounds Na_2CO_3
¾ pound Citronella

Color light pink with water soluble red dye (Azo-rubine). Dissolve the soap in hot water.

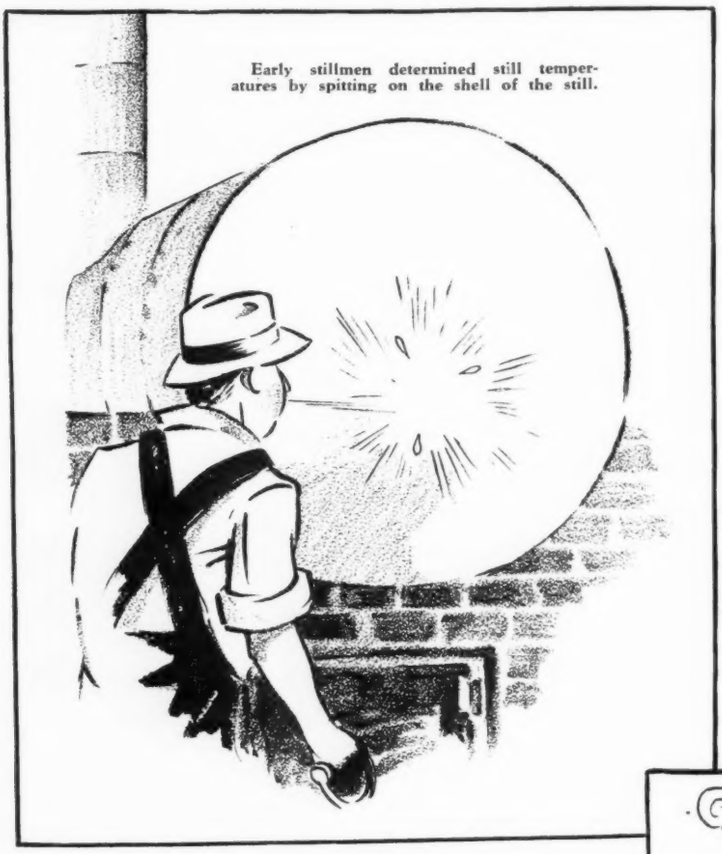
Add Na_2CO_3 to thicken. Then add abrasive and finally the perfume and dye.

The above formulae have been successfully marketed for years. In manufacturing them, it should be kept in mind that the amounts of the various ingredients may be changed slightly in any of the formulae, except in the one on Metal Polish.

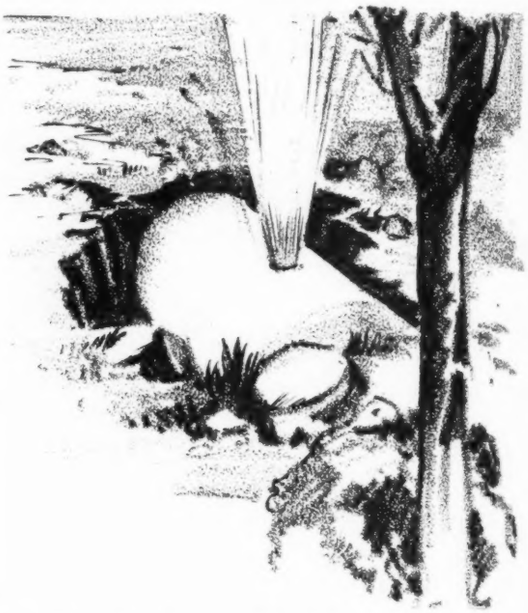


Strange but True...

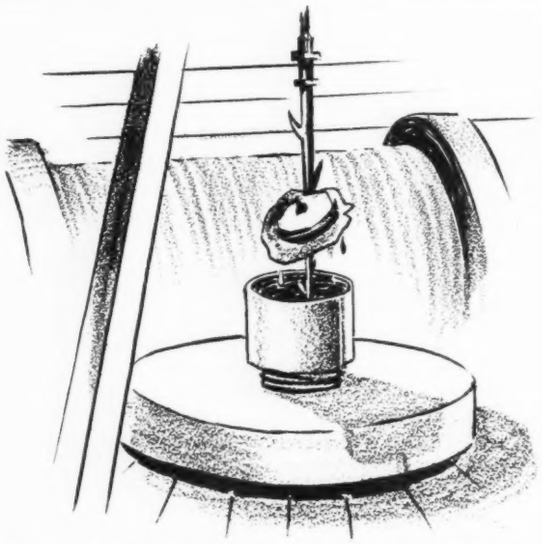
HAPPENINGS IN THE PETROLEUM INDUSTRY



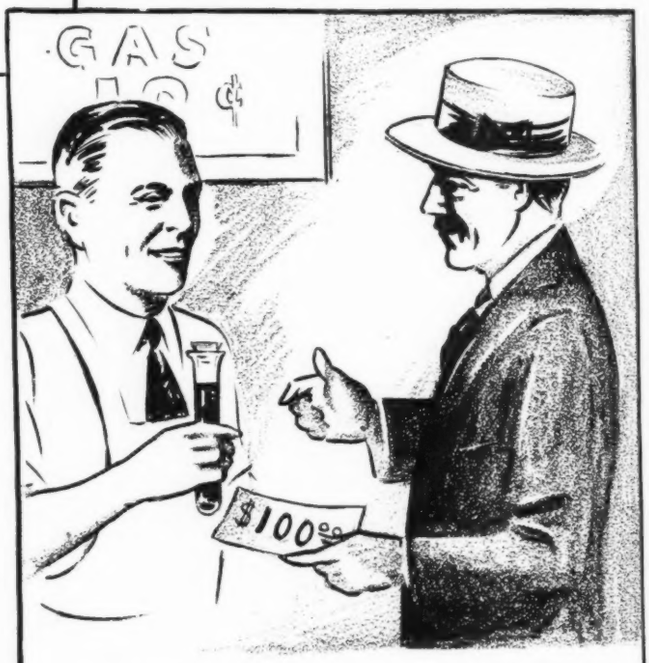
Early stillmen determined still temperatures by spitting on the shell of the still.



During cool weather a small break in a gas line will be surrounded by frost while the escaping gas is burning. The moisture from the air is sucked in close to the break and condenses on the pipe. Expansion of the escaping gas from the line carrying 300 or more pounds pressure causes it to frost around the break. Should the break be a large one or the line pressure low the heat from the fire would make the pipe hot and prevent frosting.



While running a string of large-size casing in the Oklahoma City field the towerman's straw hat blew off and dropped into the casing. When discovered that it had fallen to the bottom of the string it was decided to try and circulate mud, but the hat prevented circulation. A special fishing tool had to be made (a small spear affair) to get the hat out without pulling the pipe.



$100 for 8 ounces of East Texas oil has been paid by H. A. Pace, mayor of Arp. This is the highest price ever paid for crude oil. This high price was paid as a result of a wager over the producing possibilities of a drilling well.

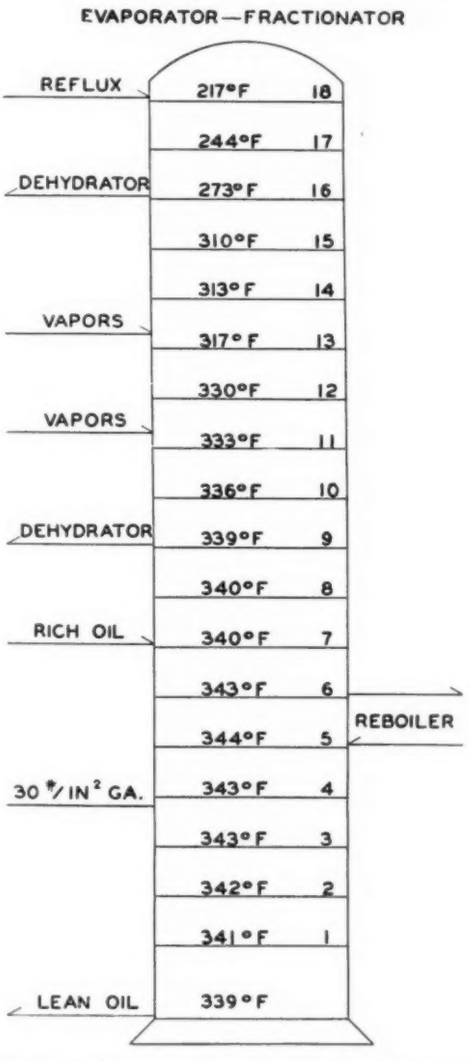
Natural Gasoline Distillation Practice

By L. J. COULTHURST*

IN THE Natural Gasoline Industry a few years ago there were evaporators in operation of the direct fire and vertical shell types, and also those which were rock-filled. When this fact is realized it would appear as though the evolution of the modern still was a quick trend of development. The wonder of it is that it took so long a period of time for the industry to accept the true function of the stripping and fractionating processes. There are numerous plants in operation today that employ a distilling column for the sole purpose of denuding the absorption oil of its gasoline fractions. The subsequent process of producing correct end-point gasoline is accomplished in another unit. The function of the modern still is to combine the stripping and fractionating operations. The uniting of these two processes in one piece of equipment is now universally accepted as good practice. The resultant of this union is denoted as a combination evaporator and fractionator. The plates above the feed inlet constitute the fractionator; those below are known as the evaporator. For simplicity this combination evaporator and fractionator is referred to as a still.

The Reboiler

The necessity for completely stripping the absorption oil of gasoline fractions with best economy caused the logical addition of a reboiler to the evaporator section. The function of the reboiler is to maintain as constant a temperature as possible throughout the evaporator section. It is thereby hoped to reduce the vapor pressure of the absorption oil to a very low value for its subsequent use as an efficient absorption medium. The various types of reboilers and places of their installation will indicate the many ideas prevailing as to their correct usage. Some units have tube bundles placed on each of two to four stripping trays; this is known as the internal type of reboiler is denoted as external. The oil gravitates source and usually consists of high pressure steam or occasionally some heating medium, such as fuel oil. A second type of reboiler is denoted as external. The oil gravitates from a selected stripping tray through an external heat interchanger back to the tray immediately beneath. The point of installation varies from between the fifth and sixth trays from the bottom on down to the first tray. The heating medium in this case also may be either high pressure steam or some type of fuel oil depending upon which is feasible.



The Dehydrators

The desirability of eliminating water from the fractionating section caused the evolution of dehydrating trays. These trays are usually two in number and it is aimed to place them where they will eliminate the most water possible. The combination of absorption oil, gasoline, and water that accumulates on the selected trays is conducted through pipes to individual external dehydrators. Water is eliminated and the absorption oil returned by gravity to the tray immediately beneath the dehydrating tray. Dehydrators may be automatically or manually controlled. The automatic type may be of two forms. One form may be a round tank or a large diameter pipe about four feet in length; the other is an adaptation of a steam trap. Each form controls the water level by an internal float which operates the water outlet valve. The manually controlled dehydrator is a small vertical tank and is placed on the ground for accessibility reasons.

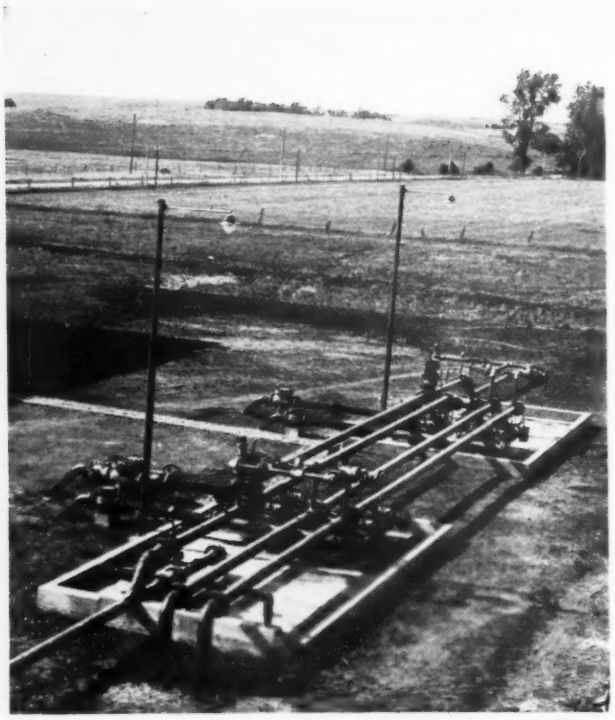
Reflux Methods

There are various interesting schemes for producing and handling reflux for the fractionating section. Some schemes employ a gravity type of refluxing. This method involves the elevating of the condensers to a higher level than the top of the fractionating section. Thus the desired gasoline is allowed to gravitate back onto the trays for refluxing purposes. In one particular commercial distillation unit the atmospheric type of condenser produces a refluxing medium which is a combination of the heavier fractions of the gasoline and the lighter fractions of the absorption oil. The most generally accepted method of refluxing is the pump-back type which is self-explanatory. There is a variance in the actual method of pumping reflux to the fractionating section. In some units an atmospheric or closed type partial condenser is used to condense just enough gasoline for reflux purposes. A pump is emp'oyed to pump only the reflux gasoline. In another method there is total condensation of the gasoline with the result that part of the gasoline is pumped to the still and remainder of it to the storage.

* Chemical Engineer.

Above-Ground Type *of* Manifold *at* Gasoline Pipe Line Stations

By LEO TOWERS, M. E.



Above-Ground Type Manifold.

BECAUSE of severe climatic conditions, The Great Lakes Pipe Line Co., Kansas City, Mo., has changed to the "above ground" type of manifold at its northern stations. However, the conventional pit-type manifold is used at stations on the southern and central sections of the line where deep drifting snow is not so troublesome as in Minnesota and Illinois. The above-ground type of manifold was used with success during several storms last winter.

A characteristic one of the inverted manifolds was installed at Fairbault, Minn., the station farthest north on the Des Moines, Ia.,-St. Paul, Minn., section of the line. Its principal difference from the pit type, other than being above ground, is that the headers are above the gate valves rather than below. This allows approximately three feet clearance from the ground to the pipe except where the suction and discharge barrels enter the manifold.

The manifold is supported under the tees by I-beams which, in turn, are supported by concrete footings that extend to solid ground. Additional supports are placed under the incoming and outgoing lines at a point near the scraper box. As a safety precaution against leaks, a concrete slab with a curb and drain is placed beneath each battery of valves.

So identical in principle of design to the pit-type manifold is the above-ground type that, with a few field variations, the same fabricated manifold is used on all stations. The vast difference in appearance, however, is shown by the accompanying illustrations.

Where the pit-type manifold provides for connecting lines to reach the fabricated piping on a horizontal plane, the new type causes the lines to rise above the ground for connection. The incoming and outgoing lines are brought above the ground with long sweeping reverse bends to permit a line scraper to enter the scraper box. The field tank lines rise vertically from the ground at the end of the manifold and connect, by means of fittings for welding, to the tank headers. The pump suction and discharge lines are carried under ground from the station building to the strainers and check valves. At this junction the lines are brought above ground at a 45-degree angle to connect with the strainers and check valves by means of flanges and fittings for welding.

This inverted type layout called for a change in valves. On the pit-type manifold a rising stem gate is used. Because the main headers are directly over the valves, and to keep from extending the manifold horizontally, a more compact valve is needed. For this work a lubricated plug valve was selected. The valve is the worm-geared opening and closing type with the wheel close alongside the valve body. The valve makes a compact arrangement and has served efficiently under pressure.

Gauge line connections, thermometer wells, sample connections and the by-pass lines are installed in a similar manner to the pit-type installations. In appearance the manifold is attractive and the piping, as well as the concrete slab, is easily kept clean. The piping is painted and all lines are identified with stencils for convenience to operators. Maintenance and repairs are possible with a minimum of trouble, because of the accessibility of all connections.

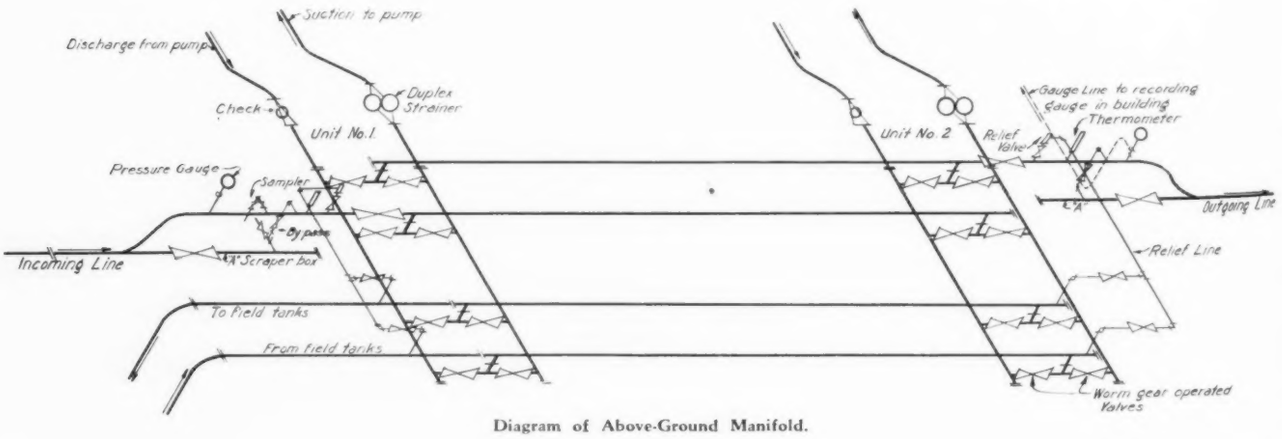


Diagram of Above-Ground Manifold.

Pipe line junction and measuring station.

The Design of an Adequate Natural Gas System

By **ROBERT W. HENDEE,** *Vice-President, Oklahoma Natural Gas Corporation*

THE last few years have seen the piping of natural gas over long distances for retail distribution in large mid-western and eastern cities. With the popularity of natural gas growing day by day, engineers are likewise finding its problems easier to solve. But there must be certain requisites for a complete and adequate natural gas system, and it is those requisites which will be discussed here.

Before a natural gas system can even be considered, two things must exist—a natural gas field or fields and at some other point, markets.

A study of a field is of first importance. The field obviously is the most vital part of the entire natural gas structure. Without a field or fields with sufficient volume and pressure, the most perfectly planned and designed transmission and distribution system would be of no use.

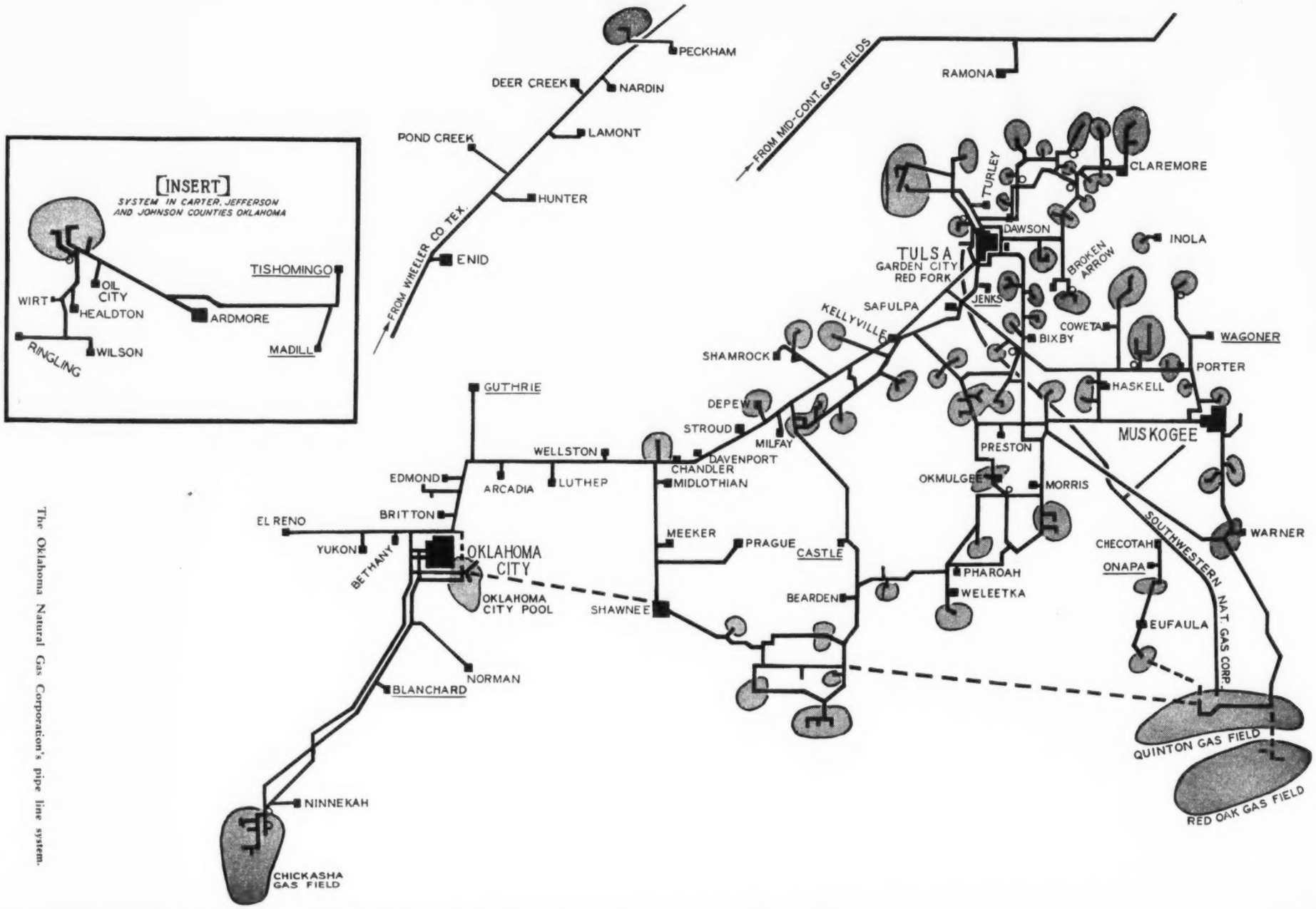
The study of the reserves which are to supply the market should be attacked most thoroughly and by all known methods. After this exhaustive probe has been made the findings should be regarded in a most conservative manner. When an estimate of the quantity of natural gas existing under the ground at all depths down to 10,000 feet is considered it can readily be understood, but not seen, how many unknown factors can arise to send the estimate reeling. Water encroachments, pinching out of the sand, breaks in the sand and similar unforseen possibilities may all tend to lower the best of estimates.

Engineers cannot determine definitely the extent of a field. At best they are liable to be wrong, such as the case in dealing with all intangibles.

Cognizant of these facts, several things should be considered before thought is turned to the pipe line network. Gas reserves sufficient to last at least 15 years and preferably 20 to 25 years should be absolutely proven. There is always the possibility, of course, of other reserves being developed, but this should not be given much consideration in planning the system.

Very naturally an intensive study of the market possi-

Construction work in a draw on the Chicago 24-inch line.



The Oklahoma Natural Gas Corporation's pipe line system.

bilities should then be developed. Only a few years ago such a study was encompassed with many guesses and the personal opinion of the individuals making the survey. But during the last few years, through the various committees of the American Gas Association, working on special subjects and through the contributions of individuals in the various trade journals, the industry has been given facts and figures upon which the engineer can rely. Fuel comparisons and combustion efficiencies have been established for all types of installations from the largest industrial users down to the individual space or water heater in the residence.

Add to these known combustion rates the degree day factor which is now a matter of record and the monthly, or even the daily consumption may be determined.

In designing the distribution system and the transmission lines which are to supply it, not only the daily peak load but the hourly peak must be worked out. Inasmuch as the lines of the transmission and distribution system are the only holder or reservoir which is available to take care of this one maximum hour, the design must take it into consideration. It means more than that pipe sizes and compressor stations must be large enough to accommodate the demands of this hour on a 24-hour basis. The effect must also be known on pressures throughout the entire system should that peak rate hold up for two or three hours. In other words, the reservoir known as the distribution system must be capable of receiving an increased pressure sufficient to carry over the peak demand and at the same time the transmission lines must be able to take up the additional burden by an increase of field or compressor station pressure.

One of the outstanding advantages of the low pressure system is its flexibility under such conditions wherein the first pull is upon the low pressure lines. This pull in turn may then be raised through two other reservoirs, the medium pressure lines and the one or more transmission lines leading to the market.

Whether the low pressure or the high pressure is better all the way down the line to the most important part, the economic consideration, is controversial and good arguments can be used on both sides. This is always a subject for debate. Regardless of the opinions of engineers as to the efficiency of one system as against the other, the last consideration is one of economies.

Given the field and the markets, the transmission line problem has been another on which engineers differ in opinion. Some advocate the low-pressure method while others prefer the high-pressure system.

Not so long ago the determination of the pressure to be carried in the lines was dependent upon the wall thickness of the pipe, and, therefore, upon the tons of steel which could be bought for the project. But with the advent of higher carbon steels in pipe and the resulting increased tensile strength, light walled pipe may now be used for both low and high pressures. This high carbon tensile strength steel has been a turning point in the economies of the natural gas business. Previous to its use the cost of the steel in a long line with capacity and strength great enough to carry large volumes of gas long distances was always prohibitive.

The determination of the size of the transmission lines and the spacing of the compressor stations is a matter of mathematical computation coupled with good engineering and operating sense. According to preliminary report of the sub-committee of the American Gas Association on pipe line flow working in conjunction with the Bureau of Mines engineers, the Weymouth formula for flow of gas in pipe lines is recommended for use in these computations. The writer has also always used Weymouth's values for compressor station capacity and horsepower evaluations.*

From the foregoing it would appear then that the design of an adequate natural gas system is a matter for the geologists, engineers and mathematicians, but the writer firmly believes that to be adequate the studies should be reviewed by those experienced in finances and accounting and by practical operating gas men.

So often technical men do not take into consideration the two vital prerequisites of any successful enterprise—will it pay and will it work?

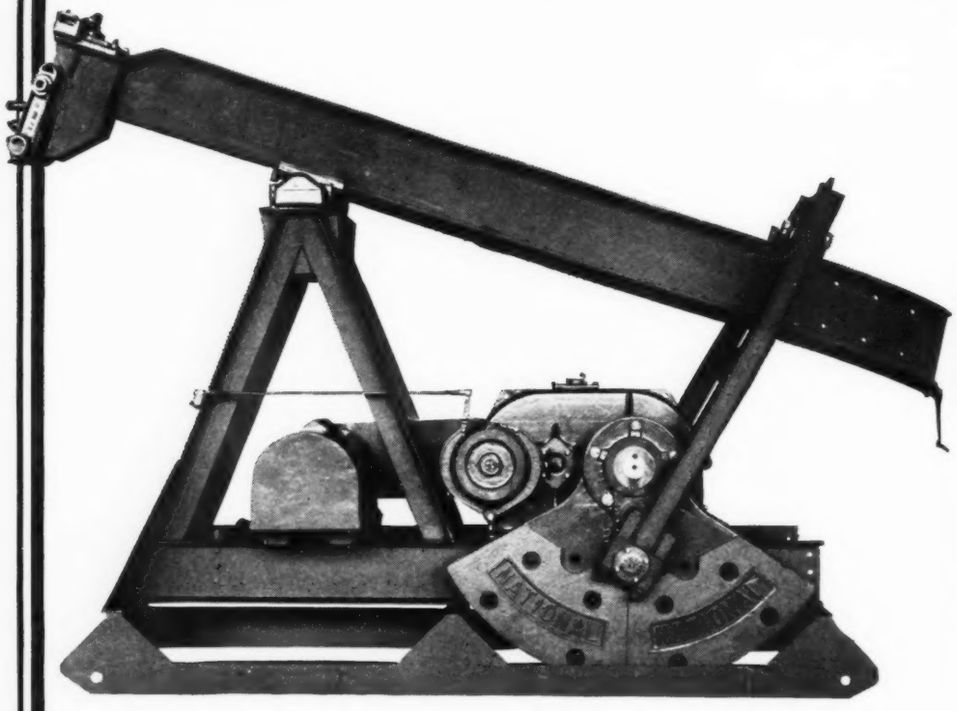
The Oklahoma Natural Gas Corporation's system is one that serves 75 communities with natural gas from more than 1,000 wells in 45 different fields over a pipe line network of more than 3,000 miles. It requires 23 compressor stations with horsepower of 13,540 to carry the load, the heaviest of which was on January 18, 1930, when sub-zero weather hit Oklahoma and the 24-hour send-out was 223,826 m. c. f. The fields and lines are interconnected so that no community is dependent on a single field or a single line for service.

* Weymouth, T. R., Problems in Natural Gas Engineering: Proceeding American Society of Mechanical Engineers, Volume 34, 1912, pages 1091-1104.

General view of The Oklahoma Natural Gas Corporation, Kellyville compressor station.

NATIONAL PUMPING UNIT

TYPE SW-130



- Welded steel frame
- Straight line motion
- Double reduction gear
- Oil-tight gear case
- V-belt drive
- Retractor beam
- Double pitman
- Twin counterweighted cranks
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A complete, compact, self-contained Pumping Unit of modern design and rugged construction, adaptable to any type of prime mover.

Descriptive literature free on request

THE NATIONAL SUPPLY COMPANIES

Vacuum Equipment and Design

By W. L. NELSON[1]

VACUUM processing equipment consists of the normal processing units except that certain parts are subjected to low pressures and these units must be designed with precautions against leaks. Also a few new items of equipment such as barometric condensers, air ejectors, vacuum controls and vacuum pumps are necessary.

Vacuum Pipestill Heaters

Designers have universally agreed that a pipestill containing a large proportion of radiant heat absorption surface is desirable. For vacuum processing the value of this type of still is even more pronounced. Theoretically and practically, the amount of heat that is radiated from a flame is not directly dependent upon the amount of radiant heat-absorbing surface. (However, the furnace temperature as a whole may be lowered.) Thus the quantity of heat absorbed per square foot of a small absorbing surface is much greater than the heat absorbed by a square foot of surface when the total absorbing surface is large. Of course, radiation is proportional to the difference in the fourth powers of the temperatures of the radiating and absorbing surfaces, but in most pipestill installations the temperature of the absorbing surface is so low, compared with the flame temperature that the exact temperature of the absorbing surface need not be known. Not until the radiant absorption surface becomes very large, such as one square foot of surface (projected area) supplied for each 40,000 B. T. U. of heat developed in the flame, is the temperature of the flame lowered to an appreciable extent.

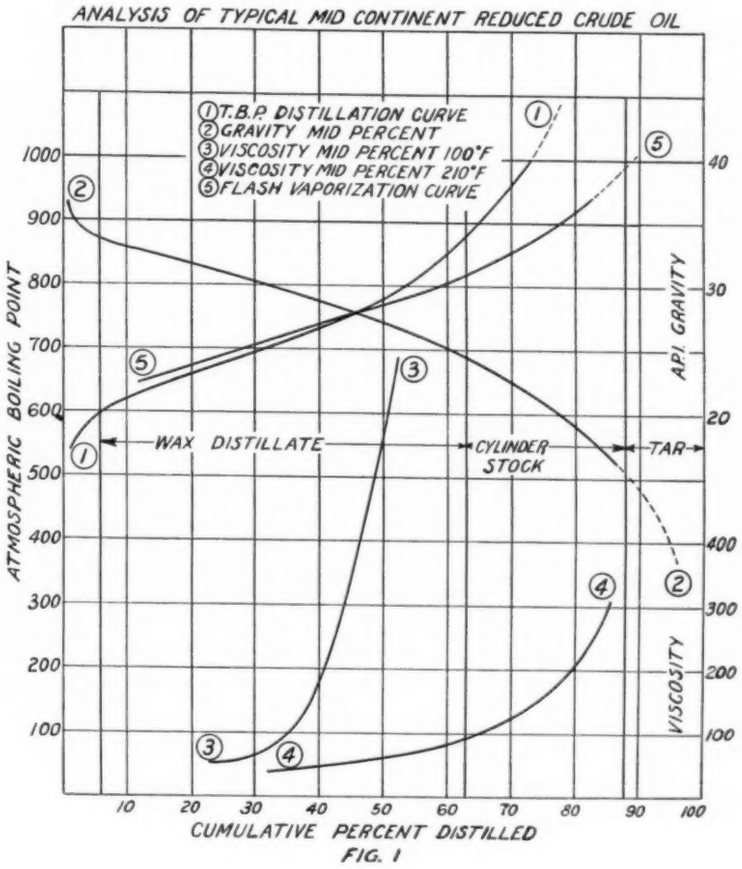


FIG. 1

Although radiant type pipestills are now being adopted for almost all processing work, the value of this type of still is doubly important in vacuum plants. Local overheating of the stock causes (1) the formation of tarry polymerization products; (2) decomposition of the stock with a decrease in yields; (3) the formation of dark colored materials which add to the expenses of treating, and (4) the formation of waxes which may spoil the processing or centrifuging properties of the oil products. In the prevention of overheating there are two methods of attack. The velocity of the oil past the heating surface may be increased or the rate of heat absorption per unit surface may be decreased. The first practice tends to wipe away the stagnant film of oil which lies nearest the heating surface and the second practice so reduces the temperature of the film that serious decomposition cannot occur. In practice neither of these methods can be successful if used alone and therefore we attempt to design so that the maximum advantages of each may be attained. Should the velocity be very high, the pressure drop through the still may become prohibitive. Further, if the radiant absorption rate be greatly lowered, the cost may become prohibitive by virtue of the abnormally large surfaces (pipestills) that are required. As a common figure, about one square foot of radiant surface (projected) is supplied for each 44,000 B. T. U. developed in the flame and a velocity of eight feet per second is maintained in the radiant section. Of course, these data are an average, and a particular design may require a drastic departure from them. At such velocities the charge pressure usually varies between 250 and 350 pounds per square inch. Care should be exercised in placing the radiant absorption surface in a symmetrical arrangement because certain sections of wall or corners of the furnace do not receive even half as much radiation as others. For this reason the vertical cylindrical pipestill and the furnaces with three cold walls have been receiving attention.

Tower and Plate Design

As mentioned in a previous article the fractionation which lubricating oil stocks undergo is of vital importance in facilitating the subsequent operations of dewaxing and treating. However, the problem of vacuum fractionation is not simple because of (1) the large ratio of vapor to liquid; (2) the structural difficulties involved in keeping the pressure drop low and at the same time without exceeding reasonable size limits, and (3) the low pressures which must

[1] Professor of Refinery Engineering, University of Tulsa.

be maintained. Joints are universally welded (unless this is impossible) and for additional strength the joints are often both "butt" and "strap" welded.

Necessarily the diameter of the tower is great and the reflux liquid must traverse a long path across each tray. This often leads to channeling of the reflux liquid and to obviate this difficulty the plates are sometimes built as follows:

(1) With a series of bubble decks, each deck at a lower level and separated from other decks by overflow weirs, so that the liquid is redistributed as it cascades from deck to deck;

(2) With down pipes in the center of the plate so that the liquid travels uniformly outward over the plate in all directions to a receiving trough and downpipe;

(3) As a series of overflow plates and baffles (no caps) so that the vapor ascends through a series of liquid streams or particles.

In order to allow more slot area than ordinary trays allow, the bubble caps are usually made of shaped steel rather than cast iron and some manufacturers have adopted tunnel caps which extend across the entire column. Since the pressure drop through the plate must be kept at a minimum, the static head of liquid (or froth) above the slots of the caps is usually limited to a maximum of ⅛ inch. In a few installations the caps have been suspended above the trough of the plate by beams connected to the shell of the tower. Thus, if the plate should warp so that it is not level, the caps will still be immersed to the same depth in the liquid.

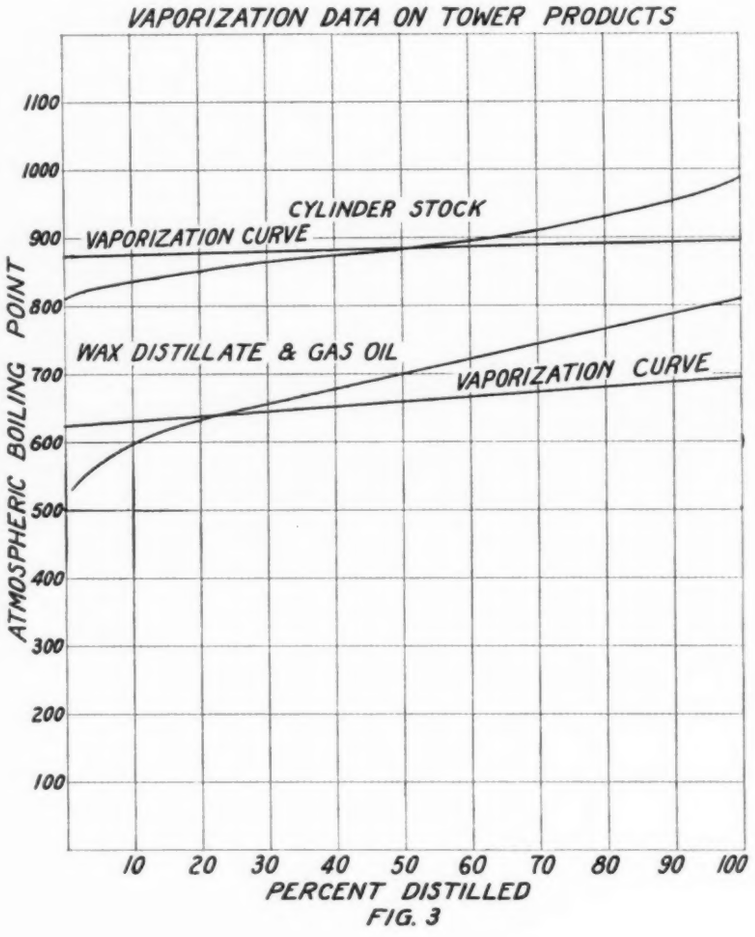


FIG. 3

Reflux and Partial Condensers

Since the volume of vapors under vacuum conditions at the top of the tower is large, most designers have advocated the withdrawal of most of the reflux heat by reflux condensers placed in the top of the tower. Thus the vapor lines leaving the tower are reduced in size and the friction loss through the vapor line may be more easily reduced. Other designers have gone even further and have arranged to condense the wax distillate and gas oil in partial condensers which are supported above the tower (note Figure 2). This arrangement even further reduces the size of vapor line required, but at the same time requires expensive structural supports for the heavy partial condensers. Sometimes these condensers weigh as much as 100 tons. Furthermore, only a rough separation of the wax distillate and gas oil can be obtained by partial condensation. However, most refiners prefer a wax distillate which contains some gas oil because the pressing operation is facilitated and hence the poor separation of gas oil and wax distillate is not as serious as it might at first appear.

These partial and reflux condensers must be constructed so that a minimum pressure drop occurs on the vapor side. Thus the limiting factor is the vapor velocity and we find that the quantity of heating surface (tubes) is not vitally important. Of course enough surface must be supplied for the exchange of heat, but the real difficulty lies in the provision for ample vapor space. These condensers are now built so that the pressure drop is as low as 1 mm. per unit of condenser for small condensers.

Usually the condensers are built for a vertical position so that vapors travel downward around a baffle and then upward to the outlet, and the liquid drains down the tubes and baffles to the bottom of the exchanger. Sometimes several baffles are used in the larger condensers. The reflux condensers are usually inserted directly into the top of the tower and the tube bundle is free to expand downward. To avoid leaks by expansion the reflux and wax distillate condensers are usually cooled by pre-heating the reduced crude charging stock, but the final condenser is cooled with water. The temperature of the vapors leaving the final condenser is of great importance in the design of the barometric condenser and ejector equipment. The temperature of the cooling water must be low and the surface in the condenser must be ample in order to condense the gas oil when at such low pressures. Even with properly designed units some gas oil is not condensed and finally leaves the system with the water in the leg of the barometric condenser.

Design of a Vacuum Tower

Figure 1 presents data [2] which was obtained in the laboratories at the University of Tulsa. Figure 2 indicates the general arrangement of the vacuum tower.

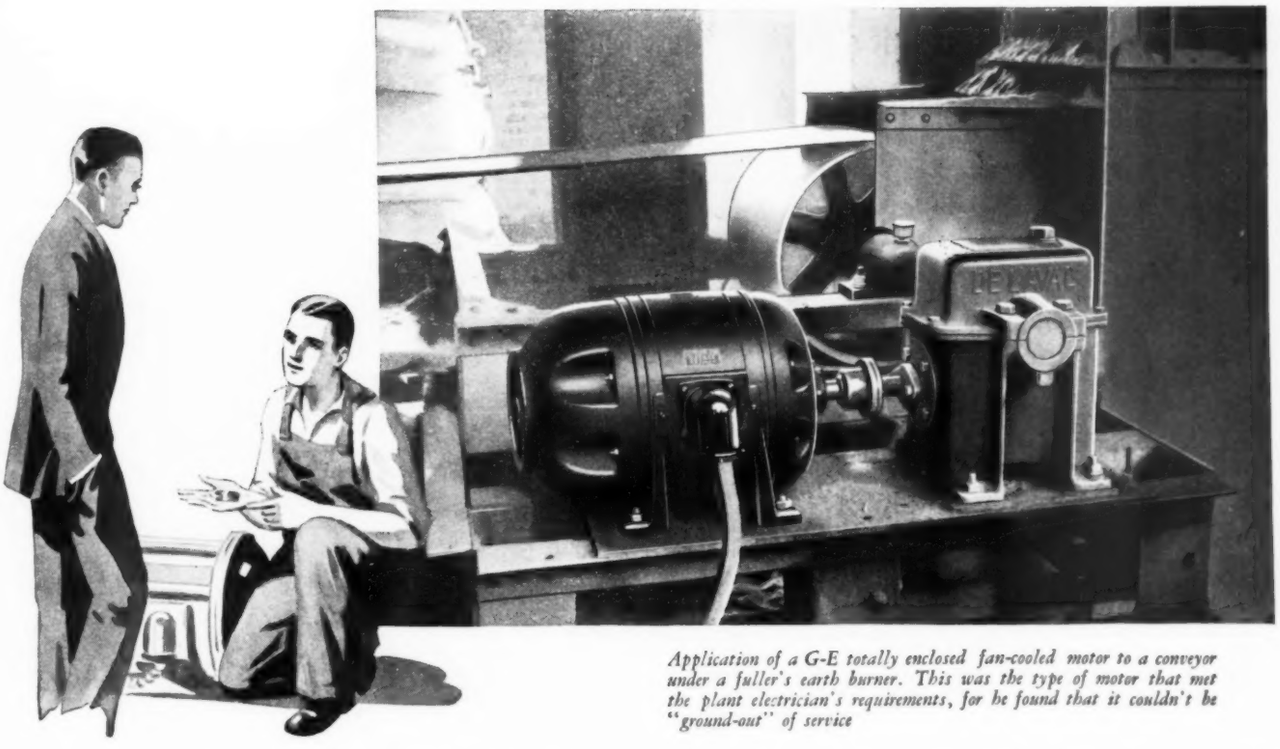
Basis: 1 hour.

Charge—2,000 barrels per day or 83.2 barrels per hour.

	% on R. Crude	% on Crude	G.P.H.	A.P.I.	Lbs./Hr.	M.W.[3]	Mols	Properties
Gas Oil	6	3.06	210	34	1,495	228	6.56	
Wax Distillate	57	29.05	1995	30	14,580	307	47.5	86 Vis. at 100° F.
Cyl. Stock	25	12.76	875	20.7	6,780	630?	10.75	165 Vis. at 210° F.
Tar	12	6.13	420	10.0	3,500			
R. Crude	100	51.00	3500	25.2	26,355			

[2] W. L. Nelson, The Petroleum Engineer, April, 1931.
[3] W. L. Nelson, The Petroleum Engineer, February, 1932.

"It makes a swell grinding compound BUT - - what it does to motors is nobody's business!"



Application of a G-E totally enclosed fan-cooled motor to a conveyor under a fuller's earth burner. This was the type of motor that met the plant electrician's requirements, for he found that it couldn't be "ground-out" of service

THAT was how one plant electrician expressed himself . . . the "it" in question being that potent mixture which occurs when fuller's earth and oil get together. But it is somebody's business . . . everybody's business, to be exact . . . when motors "depart" because destructive substances get in.

General Electric totally enclosed, fan-cooled induction motors are designed and built to minimize maintenance difficulties and expenses under unfavorable operating conditions. They are well suited for such trying service as out-of-door operation at all times of the year; under grinders of any kind where excessive dust and dirt are present; in the presence of corrosive fumes; and in many other adverse locations.

Your operating department should have complete information about these G-E motors. Your nearest G-E office will be glad to send you a copy of publication GEA-1326A, and to answer any further questions.

For Class I, Group D, hazardous gas locations, G.E. manufactures a similar line of totally enclosed fan cooled explosion-proof motors tested and listed by The Underwriters' Laboratories. Ask for a copy of descriptive publication GEA-1341A.

200-564

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

Pressure at vaporizer—

Pressure at ejectors	16.5 mm. (assume)
Vapor line loss	2.
Condensers (3 units)	9.
6 plates	6.
Pressure at vaporizer	33.5 mm.

Process Steam Required

Allow a vaporizer temperature of 730° F.
Vaporizer temperature if at 760 mm. = 990° F.
Vaporizer temperature at 33.5 must be 730° F. (use steam).

If no steam is used the pressure would need to be 21 mm.[4] or thinking another way the vapor pressure of the oil in the presence of steam must be 21 mm.

Using no excess vaporization—

$$\text{Mols vapor} = 6.56 + 47.5 + 10.75 - 64.81.$$

$$\text{Mols steam required} = \frac{33.5}{21} \times 64.81 = 103.5 \text{ mols.}$$

Pounds steam per hour = 1865.

(A unit operating in the Mid-Continent area under almost exactly the above conditions required 1725 Lbs./Hr. The check is reasonable.)

Heat Balance of Tower

Assume these tower temperatures and check later—

Top	450° F.
Cyl. Stock	640° F.
Bottoms	575° F.

The steam is available at 356° F.

Sensible heat contents using the flash temperature as the basis:

Gas Oil	1495 (730-450) 0.615	=	258,000 B.T.U./Hr.
Wax Dist.	14580 (730-450) 0.61	=	2,490,000
Cyl. Stock	6780 (730-640) 0.65	=	397,000
Bottoms	3500 (730-575) 0.715	=	388,000
			3,533,000
Steam	1865 (356-450) 0.47	=	— 82,000
			3,451,000

[4] W. L. Nelson, The Petroleum Engineer, May, 1931.

Latent Heats—

Cyl. Stock	6780 × 57	=	386,000
Total Reflux Heat at Top		=	3,837,000 B.T.U./Hr.

Pounds internal reflux at top of tower—

$$\frac{3{,}837{,}000}{80} = 47{,}000 \text{ Lbs./Hr.}$$

The actual reflux pumped into the top of the tower is not the same as the internal reflux. Depending upon the temperature of the reflux, the quantity that must be admitted to the top of the tower may vary widely although the same reflux heat quantity is always removed.[5]

The heat balance cannot be depended upon until the assumed tower temperatures are computed and are found to be about right.

Check on Top Temperature

Mols internal reflux $\frac{47.000}{307}$	=	156
Mols Gas Oil	=	6.56
Mols W. Dist.	=	47.5
Total Mols of oil vapor	=	210.06
Mols steam	=	103.5
Total Mols	=	313.56

The pressure at the top of the tower = 33.5-6 = 27.5 mm.

In Figure 3, the approximate distillation curves and flash vaporization curves[5] of the wax distillate (and gas oil), and cylinder stock are presented. The temperature at the top of the tower must be just high enough to completely vaporize the combined gas oil and wax distillate under equilibrium vaporization conditions. Such a temperature is the 100 per cent point on the flash vaporization curve of the wax distillate and gas oil and is 697° F. at atmospheric pressure.

[5] Refer to Nelson & Souders, The Petroleum Engineer, October, 1931.

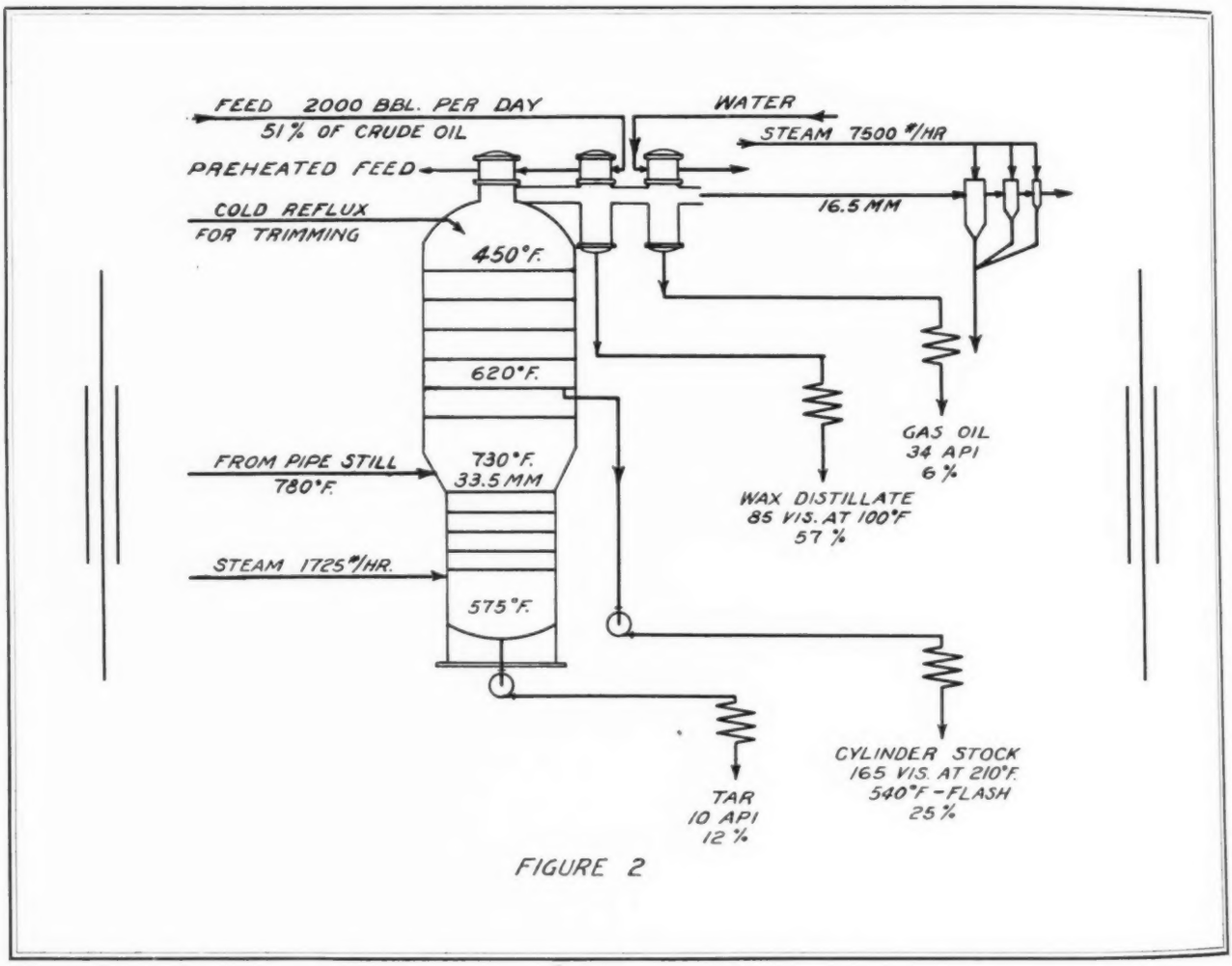


FIGURE 2

1906 1932

THE Natural Gas Association of America (now united with The American Gas Association) and the Hope Engineering Company were both organized in the year 1906; and, like The Natural Gas Association, the Hope Engineering Company is very proud of the part it has taken in the development and expansion of Natural Gas Service in all sections of the country.

Twenty-six years of successful service to all phases of the Natural Gas Industry, including design, engineering, construction, finance and management, enable us to solve your problems in the most efficient manner, and to design and construct your transportation and distribution plants in accordance with the most modern practice.

In the event you have plans under consideration to revamp your present system, or contemplate the construction of new transportation and distributing systems, we offer you the service of a thoroughly experienced and trained engineering and construction organization. Your inquiries are solicited.

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HOPE

AMERICAN INDUSTRY NEEDS MORE NATURAL GAS

Results of Well Temperature Tests in Wyoming

By BRAVITY TAYLOR

THE State Oil and Gas Inspector of Wyoming has been making a series of experiments relative to the temperatures obtained in wells in that state, with rather interesting results.

In the geologic strata of Wyoming, one great key bed is had in the main sand member of the Carboniferous system. This stratum is commonly referred to as the Minnelusa in the northeastern fields of the state, as the Tensleep sand in the central fields and as the Weber in the southwestern part.

This horizon carries hot or warm water over practically the whole state and is often found with an artesian flow.

At several points in the state, notably Yellowstone Park, Saratoga, Fort Washakie and Cody, this same horizon flows hot waters.

Here is the important factor that is expected to yield results after a comprehensive study of the Wyoming thermal conditions has been completed by the State Oil and Gas Inspector. Taking for example a hidden fold or structure where the Tensleep sand comes nearer the surface than the surrounding territory, it is reasonable to suppose that the overlying strata covering this hidden structure will show a higher temperature than where the strata are leveled off and without folding of any kind.

By taking the increased temperature of the strata over this hidden structure as a criterion in comparison with the temperature of strata in areas where no folding or structural action has taken place, it may be possible to locate a geological structure by the temperature measurements alone, if the differences in temperature can be measured accurately.

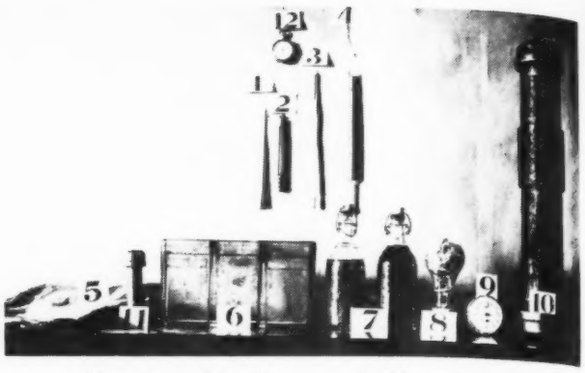
The illustration accompanying this article shows the apparatus used by the State Oil and Gas Inspector of Wyoming to obtain temperature measurements in wells with the accuracy required for a study of this nature. This apparatus consists of a protective shell in two compartments. The upper part houses a clock for making an electrical contact at a predetermined time; four cells of batteries for producing the necessary current; and an electrical base with a photographic flash lamp extending downward into the lower compartment of the shell.

The lower compartment holds two thermometers which have their bulbs and a part of the stems immersed in mercury; and two strips of sensitized paper.

The shell is made up of ordinary three-inch fittings, consisting of a cap with welded eye, a six-inch nipple for the upper compartment, regulation collar, a 12-inch nipple for the lower compartment and a collar on the bottom to the inside of which is welded two short pieces of three-quarter inch pipe with packing caps to act as wells for the thermometers. The inside of the shell is painted with aluminum paint to give better light radiation.

In operation, the apparatus is lowered on the sand line with the shell clamped to the line just above the bailer. However, some preliminary temperatures are taken before running the shell for the exact measurement.

A maximum thermometer with a constricted tube is first



Apparatus used in this system of taking well temperatures.

sent to the point where the measurement of the temperature is to be taken. This thermometer is encased in a metal armor and is tied to the sand line or a measuring line, in an inverted position. It is tied with the bulb up so that there is no danger of the column of mercury, after it reaches its maximum height in the thermometer tube, being shaken down by the vibration of the line as it is drawn back to the surface.

After ascertaining the approximate temperature at a given point of measurement with the maximum thermometer, two thermometers are selected that will register that temperature point in fine detail. These instruments divide a degree into fifths and the equipment includes a full set so that any temperature from 90 degrees to 220 degrees F. can be taken, since the thermometers have a range of 55 degrees of temperature and a lap over at each end to catch the next highest and lowest scale on the other instruments. Two are used to check against each other.

As the maximum thermometer is run in the well, the time is checked with the stop watch shown and when the shell with the fine thermometers is run, the clock is set to give the shell ample time to reach the desired depth before the circuit is closed and the magnesium foil in the lamp set off.

After the exposure is made, the shell is drawn back to the surface, and, after the fluid has been cleaned off the shell (if the well has a hole full of fluid) it is placed in a developing bag made of rubberized cloth with hand holes that fit tightly over the operator's wrists. Here the sensitized strips of film or paper are removed and developed in the three compartment glass tank. The developing chemicals are carried in bottles, and this part of the work is done usually on a table in one of the camp buildings or on the seat in the doghouse.

After the developing and examination of the prints, a record is made in a note book of the findings and the outfit prepared for another test.

The average run of temperatures in Wyoming has been found by the State Oil and Gas Inspector to be between 90 degrees and 180 degrees Fahrenheit. While there are exceptions to this rule on both sides of the range, practically every field in the State lies within the above scale. However, it has been found that the time element in taking temperatures is a very important one in this class of research work. The temperature of the top of a sand in the Osage field in Weston County will register higher on the scale when the sand is first struck than after the well starts gassing, and temperatures taken after the gas begins to expand in the hole are so inaccurate that these have been discarded altogether. It is thought that the expansion of the gas has a cooling effect upon the static temperature of the well hole. The deepest well in Wyoming, at 8,725 feet in the second Wall Creek sand, was found to have a temperature of 140 degrees Fahrenheit.

Gas Stored *in* Tank *to* Maintain Constant Line Pressure

THE installation of an 83,000-cubic foot, 36-foot diameter, Hortonsphere tank in the gas system at Danville, Virginia, has permitted the operators of the gas system to improve the service and to maintain a uniform pressure at all times in the outlying sections of its lines.

Proper regulation of gas flow, which consists principally of maintaining a constant pressure in the lines, is an important problem because of both hourly and seasonal fluctuation in demand. During cold weather the demand is always the greatest, especially during early morning hours when stoves are freely burned for both cooking and heating purposes. In the spring and fall of the year, when the temperature changes are sudden, the flexibility of this demand is so rapid that some means of increasing and decreasing the pressure in the shortest time possible is desirable. These changes in demand loads are usually met by installation of proper regulators in the gas lines; and so when in addition to this, the above-mentioned installation is made, it is of unusual interest. Such an installation possesses many advantages where there is likely to be a shortage of gas during periods of peak loads.

The use of balloons to store gas, while repairing a broken gas line, for the purpose of supplying a town with sufficient fuel was a novelty of the past year, but now this method has been improved and made permanent with the installation of the large tank at Danville.

The tank is filled at 50 pounds pressure by two electrically driven 8 x 6 compressors, taking gas from the low pressure mains during periods of low demand. The gas is then stored until needed to maintain the gas line pressure, when it is fed back into the distribution mains through a district regulator. The operation of this regulator is automatic, instantaneously meeting fluctuations in demand, keeping the pressure in the distribution lines constant. Another effect of the tank tending to equalize the demand on the line is its accumulating gas during the low consumption periods of the day.

The tank is located in a section of the city known as Ballou Park, two and one-half miles from the gas plant. It not only meets the local peak load demands, but releases some of the plant sendout capacity for use in other sections of the city during peak periods, when the amount of gas used is two and one-half times the average daily rate of consumption.

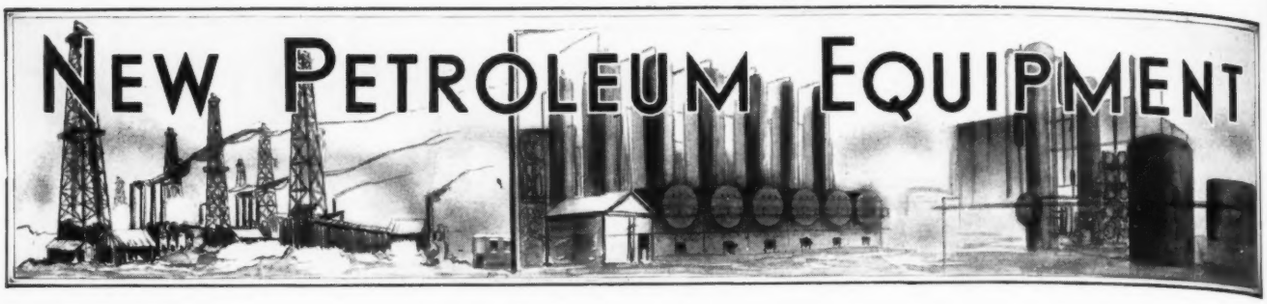
According to E. C. Brantley, manager of the system, excellent results have been obtained from the installation, which was placed in service last fall.

A somewhat similar installation is at the General Electric Company's Schenectady, N. Y., works. The tank is used for storage purposes to aid in smoothing out the fluctuations in demand on a generator, and also allows the unit to be shut down during the night.

This installation releases 50,500 cubic feet of gas at the required pressure of the system. The plant uses an average of approximately 100,000 cubic feet per day through the installation.

Additional units of this type of installations on gas systems are to be found at many industrial plants. The majority of the industrial installations are low pressure, usually ranking at about the line pressure, and much interest has been aroused by the Danville unit because it utilizes high pressures.

High Pressure Gas Storage Tank at Danville, Va.



High Range Manometer

THE MERIAM COMPANY, CLEVELAND, OHIO, has placed on the market a new instrument known as its high range manometer, Model 391. It is designed to supply a light, portable instrument for checking the accuracy of recording flow meters.

The instrument has a steel frame, stainless steel gland packers, plate glass cover, and is tested to one thousand pounds hydraulic pressure.

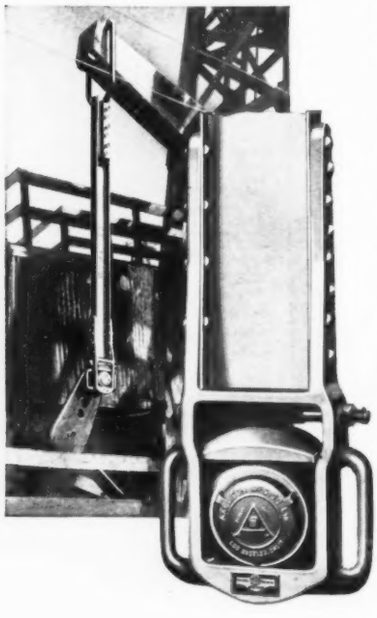
Mercury, water, or Meriam No. 3 Fluid, having a specific gravity of 2.97, may be used. With the No. 3 Fluid, this manometer will read one hundred inches of water. The standard scale is 35 inches long, the right side is graduated in inches and tenths, and the left side zero to one hundred inches and tenths of water using Meriam No. 3 Fluid.

The instrument can be used as an indicating flow meter and The Meriam Company will supply at a small additional charge the orifice plate, orifice flanges, special scales reading direct in gallons, cubic feet, pounds or any commercial units of measurement, liquid return well, control and bypass valves.

The standard instrument is 42 inches high, 6 inches deep, 4½ inches wide, and weighs approximately 20 pounds. Special instruments of any length and for higher pressures can be supplied.

Axelson Universal Pitman

CONSIDERABLE attention has been displayed by engineers in the new improved Axelson Universal Pitman, a product of Axelson Mfg. Co., 6160 Boyle Ave., Los Angeles, Calif. It is claimed that the Timken roller bearings used in the new type pitman have an actual efficiency of 98.6 per cent.



The Axelson pitman, according to the manufacturers, not only effects a decided saving in power, but also smooths pumping operation. The life of pumping equipment is said to be materially lengthened, and shocks attributed to "fluid hammer" are eliminated.

Because the bearings are totally enclosed, frequent lubrication is unnecessary and lubrication does not flood the walk and timbers around the pitman.

The spherical mounting of the bearing housing allows the pitman to align itself directly between the beam and crank. To swing the pitman away from the crank, it is only necessary to unscrew the lock nut and remove the tapered key and cap piece.

A copy of a new circular describing this improved pit and showing in chart form how pumping shock is reduced will gladly be mailed upon request by the manufacturers.

Lincoln Push Button

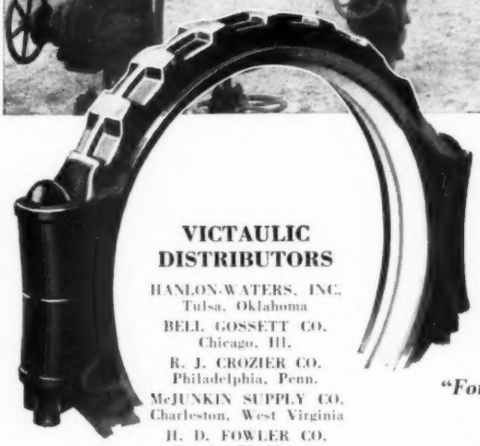
THE Lincoln Electric Company, Cleveland, Ohio, announces a number of improvements in its safety push button, introduced to the trade early last year.

A feature of this push-button switch is that the start button is inside of the stop button. The stop button can be operated from any angle by merely striking the front of the control box with the flat of the hand, but the start button must be operated with the finger. With the new push button, the stop button can be locked in the off position by pushing it in and twisting it to the right. Heavy springs prevent accidental operation of either button when not locked.

It is claimed the button will handle the heaviest control circuits up to 600 volts A. C. or D. C. because the contact opening is larger than usual. This is because the contacts are of extra heavy double break solid copper and have a positive wiping action. Contacts are enclosed in a dustproof, cold moulded asbestos case.

The button is self-contained and need not be taken apart or even removed from the box cover for wiring. All the terminals are clearly marked and brought out of the case to the back where they are easily accessible. The new safety switch is known as type A-31.

"For every joint on the line"



A "Short Haul" with a "Pay Load" —from Well-Head to Separator —via Victaulic

Victaulic Couplings are used on this hook-up of a major operator in the mid-continent field, where leak-tightness under high pressure is essential. For speed and economy of installation, for minimum maintenance costs on oil, gas, water and air lines, Victaulic Couplings have earned the preference shown them.

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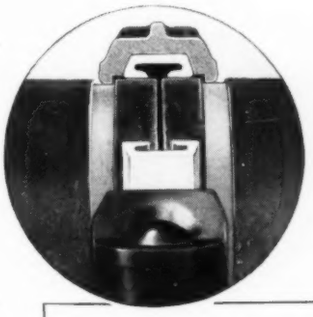

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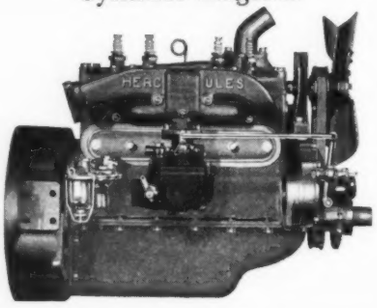


THE Hercules Motors Corporation of Canton, Ohio, in announcing the IX series engines and power units had added the following models to its present line of modern and advanced heavy-duty four and six-cylinder engines, thus giving a complete range of sizes from 9 to 175 horsepower:

Model	Bore	Stroke	Displacement
IXA	3	4	113.1
IXB	3¼	4	132.7

The two models are identical in general design and the majority of the parts are interchangeable; the only difference being in the bore sizes and the parts affected thereby. The maximum torque of the IXA is 76 pounds developed at from 1400 to 2400 r. p. m. and on the IXB is 90 pounds developed from 1400 to 2300 r. p. m. Both models peak at 3200 r. p. m., the IXA developing 39½ horsepower, the IXB, 46½ horsepower.

Special consideration has been given to valve cooling, the engines and power units are equipped as standard with a No. 5 standard S. A. E. bell housing, but the No. 4 and No. 6 can be supplied upon request. Standard practice includes thermosyphon cooling, but the water pumps are available if specified. Lubrication is of the full force feed type to the main bearings and connecting rods, the pump is located beneath the center main bearing and driven from the camshaft by helical gears.

As in all Hercules engines, the IX series have the crankcase cast integral with the block. The crankshaft is two inches in diameter at the three main bearings, of which the front bearing is 1⅞ inches long, the center bearing 1⅝ inches long and the rear bearing 1⅝ inches long. The connecting rod bearings are 1¾-inch in diameter and 1⅛ inches long, and the center to center length of the connecting rod is 6⅞ inches.

The pistons normally are of cast iron and carry three rings above the pin. The lower ring is of the oil regulating type. Compression rings are ⅛-inch wide and the oil rings 3/16-inch.

The engines have L-head cylinders and the valves are of 30 degree seat. The exhaust valves a clear diameter of 1⅛ inches and the intake valves of 1¼ inches. They are operated by mushroom type tappets of steel construction with cast iron face.

Multi-Stage Centrifugal Pumps

A NEW series of Multi-Stage Centrifugal Pumps has been announced by Wilson-Snyder, Pittsburgh, Pa. These pumps are designed for boiler feed, mine, hydraulic and high pressure oil service.

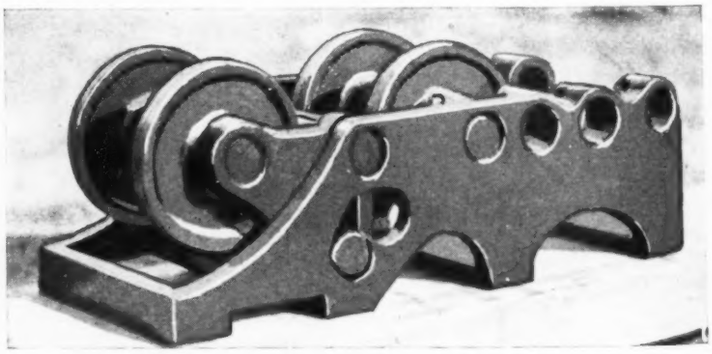
The pumps are of the horizontal single suction type having the pump case split on a horizontal plane parallel to the shaft on the center line. Suction and discharge openings are both located in the lower half of the case, and the pump can be opened without disturbing piping connections. Dowels hold the upper and lower parts of the pump case in alignment.

The impellers are of the enclosed pattern, single suction type, and in standard construction are cast of special bronze, but can be cast in metals most suitable for the service specified. The impeller and case rings are of the labyrinth type made of special bronze. A different alloy is used for the impeller ring than for the case ring to insure longer wear.

Hydraulic balance is accomplished automatically by means of a proven two-throttle system which accurately maintains the proper pressure in a balance chamber while the pump is handling liquid against discharge pressure.

Wilson-Snyder will be glad to send full specifications of this new centrifugal pump to anyone interested.

Cardwell-Allsteel Pipe Ejecting Dolly

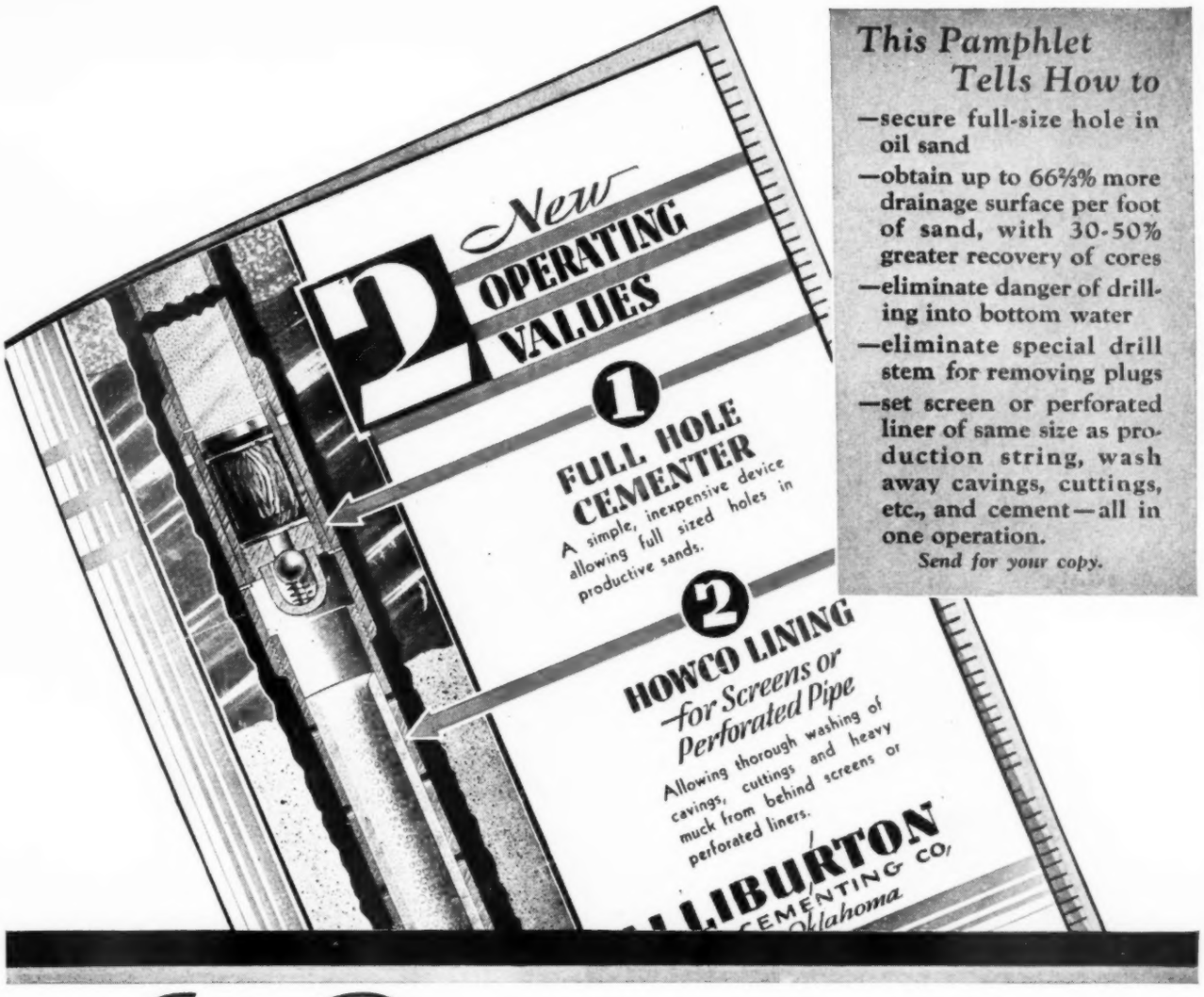


THE Cardwell-Allsteel pipe ejecting dolly, a product of The Allsteel Products Manufacturing Company, Wichita, Kan., is a self-ejecting, adjustable dolly developed through the cooperation of pipeline men.

It is instantly adjustable for any size pipe ranging from four inches to thirty inches in outside diameter. The adjustment is accomplished by simply removing one cotter key and pin, and placing in proper hole for the selected size of pipe.

To eject pipe from the dolly, it is only necessary to place a swagged-end bar, such as pinch bar, under the trip-pin and strike with a hand hammer; the pipe rolls off toward the ditch.

The dolly is sturdily constructed of high-grade material and castings; may be handled the same as any other pipe line tools without danger of breakage or throwing out of adjustment. The wheels, which are four in number, are made of cast steel, accurately machined with 1⅛-inch hubs to insure free turning, and with sufficient bearing to assure them always running true. The wheels are close together so the dolly does not "cock" during line-up and each wheel turns independently.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Oxweld Welding Heads

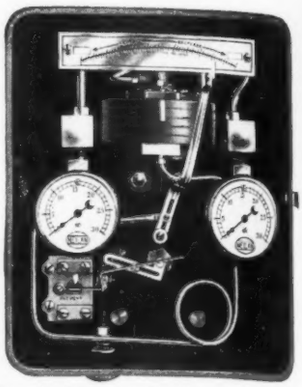
A NEW series of welding heads with detachable tips has been introduced by The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., for use with the Oxweld Type W-17 welding blowpipe. These will supplement the one-piece style heads for this blowpipe, so that the user will have a choice of two types of welding heads.

The new detachable tip heads were developed particularly for pipe line welding and for production operations. The new tip produces the same type of flame as that produced by the one-piece welding head for the Type W-17 blowpipe. Sizes Nos. 6 to 13, inclusive, are available in the new welding heads.

One of the practical features of the new design is the very satisfactory connection between the tip and the stem provided by the male thread on the tip which screws into the stem. Removal or replacement of the welding tip is greatly facilitated by this feature.

Non-Recording Flow Controller

THE Neilan Division of Mason Regulator Co., Boston, Mass., and Los Angeles, Calif., manufacturer of automatic control equipment, announces a new non-recording flow controller. This instrument is said to be the first flow control instrument available in the non-recording type.

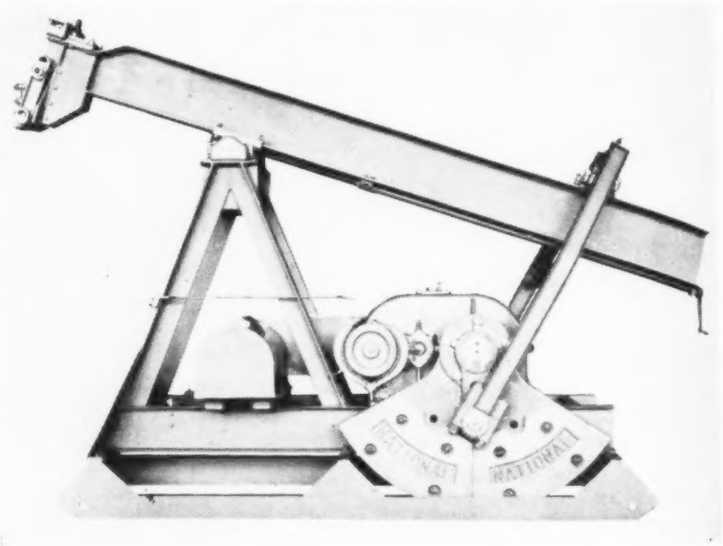


The construction is extremely simple, only a slight amount of force is required to operate the fully balanced Neilan compound pilot valve. This force is supplied by the differential, acting through stainless steel mercury pots. Like other Neilan controllers, this device is also equipped with the exclusive safety elbow which protects the instrument in the event that the differential exceeds the range of the controller.

The instrument is so made that it is easily converted from one differential range to another. Furthermore, it can be set from the outside of the case by simply turning a knurled thumb nut. It operates any size diaphragm control valves ⅛-inch in size or larger. Working parts are machined of Nirosta KA2 stainless steel. The operating mechanism is enclosed in a light, strong Duralumin case which is corrosion-resistant.

National Supply Markets New Pumping Unit

THE National Supply Companies have just perfected and placed on the market a new pumping unit, known as type SW-130, and designed as a complete unit for pumping wells. Although chiefly used with electric motors, it may be adapted to either high speed multi-cylinder or low-speed single cylinder engines.



The unit is compact, symmetrical, of rugged construction, and is mounted on a welded steel frame. The heavy 16-inch section walking beam is pivoted on an oil-bath center bearing and provides the same straight-line motion as used on the National type C-130 jack. A double I-beam pitman is operated by twin butterfly cranks, each adapted to carry from one to six counterweights, and bolted to spiders which are, in turn, keyed to the shaft.

Speed reduction is accomplished through a double reduction herringbone gear and a stage of V-belt drive. The gear is of extremely rugged construction, of forged steel, with two pinions of heat-treated alloy steel. Crankshaft, intermediate, and high-speed shafts, are all carried on roller bearings and the whole is totally enclosed in a heavy, ribbed, oil-tight and dirtproof gear case.

The V-belt drive consists of a 12-inch driven sheave and a 9-inch motor sheave with eight cog belts as standard equipment, although larger or smaller motor sheaves are available if desired. The V-belt drive is enclosed in a welded steel guard.

A special attachment to be bolted to the beam can be furnished for the purpose of pumping a second jack well.

An illustrated bulletin giving complete details may be had upon request at any of the National stores.

1,600—20" O. D. x 9/32" Creased Bends were installed in Columbia Gas Construction Company's line from Kentucky to the East.

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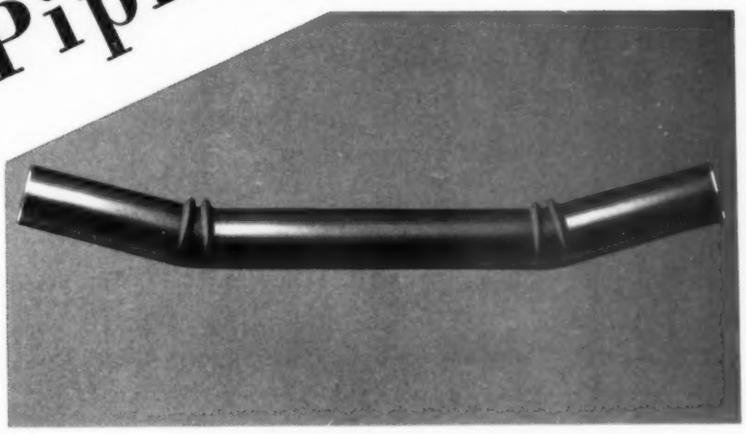
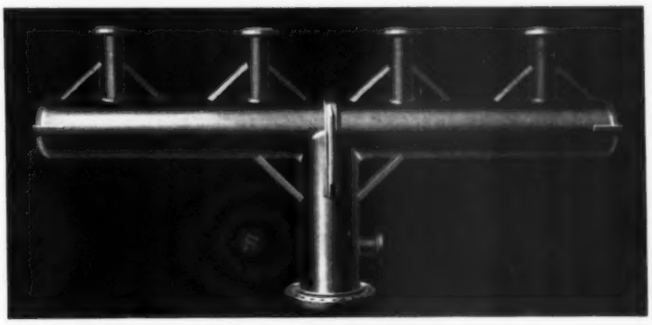
for OIL and GAS PIPE LINES



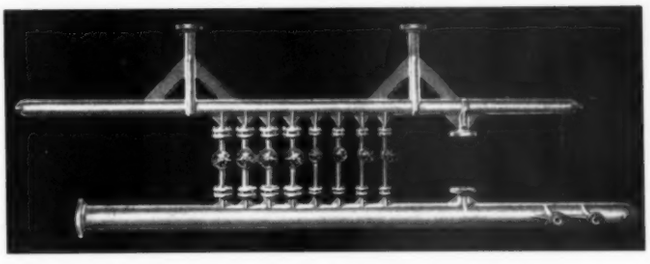
20" O. D. x 5/16" Thick Creased Bends, 30'0" long.

Creased Bends eliminate delays and save the trouble of making hot or cold bends in the field. They are made in our plant and are shipped ready for welding into the line.



20"—250-lb. pressure header.

Pittsburgh Piping also fabricates all types of pressure regulators and headers for oil and gas line service. Every header is Durex-welded (Pittsburgh Piping's improved method of welding) for greater strength.



10"—2,500-lb. pressure header for well connections.

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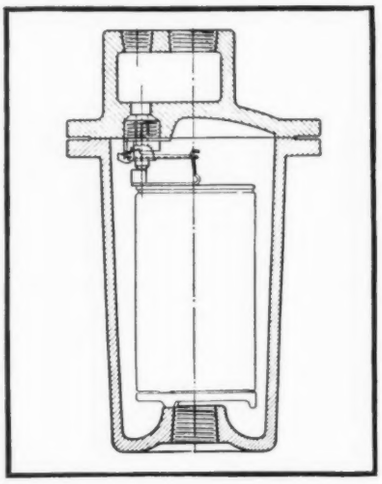
High Capacity Steam Trap



LARGE capacity and simplicity feature the Free Floating Lever steam trap developed by the Armstrong Machine Works of Three Rivers, Mich. This new trap uses the inverted bucket principle, which insures, according to the makers, non air-binding, self-scrubbing and other characteristics.

When the bucket floats, it pushes directly against the valve stem (the valve lever which loops over two guide posts at one end engages the bucket hook at the other), forcing the valve to its seat.

Steam pressure within the trap holds the valve against the seat. Water entering the inverted submerged bucket causes the bucket to lose its buoyancy and exert a pull on the end of the lever. The valve is opened as soon as the weight of the bucket multiplied by the high leverage is greater than the pressure holding the valve against the seat. When opening, the valve lever fulcrums on the knife edges which bear directly on the valve seat.

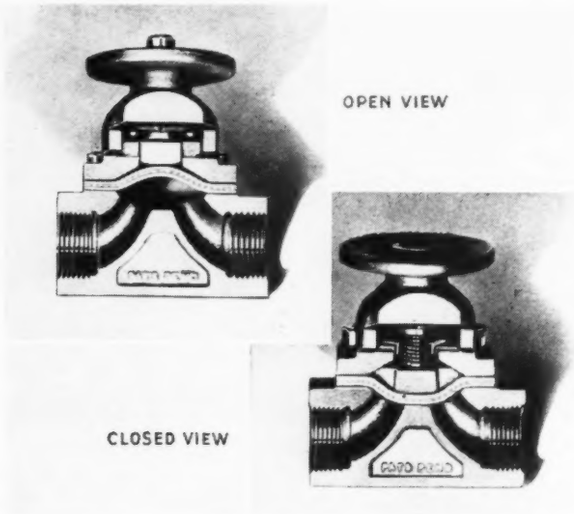
Excessive wear on the operating mechanism is prevented by the high leverage for opening the valve and a direct 1 to 1 lift for closing and the knife edges make it possible to open larger diameter orifices at a given pressure and also eliminates friction.

These new traps are furnished in cast semi-steel for pressures up to 250 pounds. In the forged steel pattern they are available for 600, 900, and 1,500 pounds pressure service with any degree of superheat.

Non-Metal-to-Metal Seat Hills-McCanna Valve

THE Hills-McCanna Company, 2349 Nelson Street, Chicago, has acquired manufacturing and sales rights on a valve that was designed and perfected by P. K. Saunders, a mining engineer in South Africa. The valve was originally intended to eliminate leaks in water and air lines that caused a large unnecessary expense each year.

This valve has no metal-to-metal seats, no stem packing or stuffing boxes, and is recommended for general service. The materials handled never reach the valve bonnet and the diaphragm protects all the working parts from the substances handled. The manufacturers state that corrosion-resisting valves of any commercial material are priced very low because the design requires only the body to be cast of special metals.



In the closed position the diaphragm is compressed between the compressor follower and the seat. An even distribution of the pressure on the diaphragm is secured through proper design and machining of the seat and compressor.

Creflex Bends

AFTER years of research, Pittsburgh Piping and Equipment Company, Pittsburgh, Pa., has developed Creflex Bends to meet the most exacting requirements. This necessitated an extensive study of the functioning of these bends and the development of special machinery and equipment for their correct manufacture.

Creflex Bends are fabricated from seamless steel pipe; the creases project outward from the pipe, thus providing a full opening throughout the bend.

The method of making Creflex Bends is such that they can be manufactured with a radius as small as one and one-half times the nominal diameter of the pipe. They are not limited in thickness, but are made to conform to the thickness recommended by the American Standards Association for the class and pressure of the piping system. Several Creflex Bends can be made in one continuous length of pipe in one or more planes.

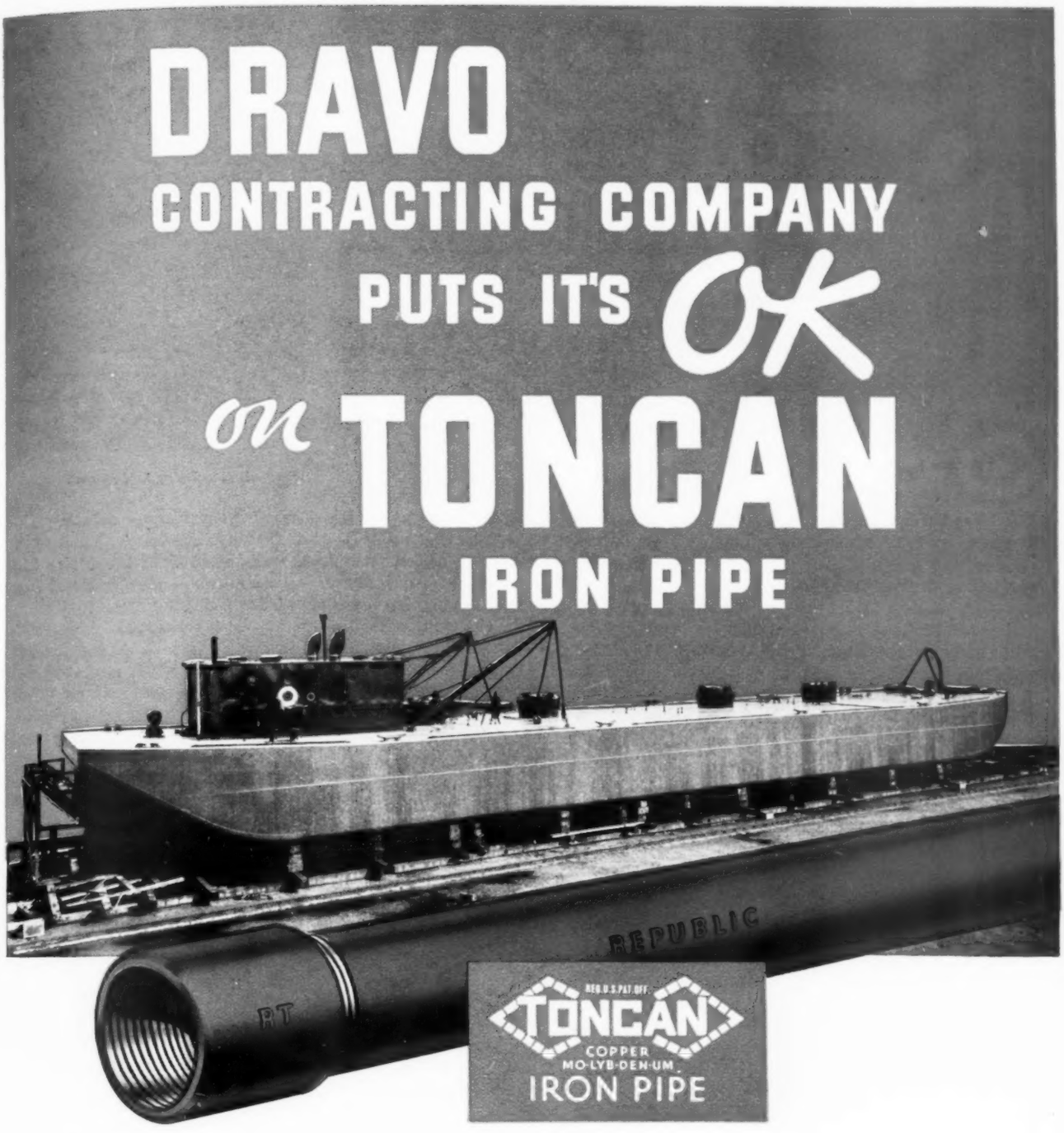
Improved Daniel Orifice Fitting

WITH the announcement that many important improvements have been made in the Daniel Orifice Fitting, the J. A. Campbell Co. has devoted several months to its final development and has placed the fitting in production. The company will have complete control in the manufacture and distribution of this orifice fitting.

J. A. Campbell states that the plate can be changed and inspected in from one to three minutes, regardless of the amount of line pressure. One wrench performs all of the operations, making it much simpler in control. The plate operating mechanism is said to be so powerful that a 1,000-pound pull is easily exerted by a turn of the wrench.

Literature describing the fitting can be procured from the J. A. Campbell Co., Box 669, Long Beach, Calif.

DRAVO CONTRACTING COMPANY PUTS IT'S OK on TONCAN IRON PIPE



The illustration shows a 10,000 barrel capacity oil barge of standardized design built by Dravo Contracting Company, Pittsburgh, Pa. The hull is 175 feet long, 40 feet wide and eleven feet six inches deep. These barges are designed for seaboard and harbor service, transporting fuel oil, refined oil or gasoline from refineries to consuming ports.

Toncan Iron pipe is used in 4, 6 and 8-inch sizes for cargo piping, extending the full length of the barge. Extra heavy Toncan Iron 2-inch Pipe is used for steam smothering and fire prevention lines. All cargo heating coils are also of Toncan.

Toncan Iron Pipe was selected after a thorough investigation proved the high rust resistance of this alloy of refined iron, copper and molybdenum in service where the combined action of moisture, salt and sulphur would quickly play havoc with ordinary ferrous pipe.

It will pay you to investigate the merits of Toncan Iron. Write for the 64-page book, "Pipe for Permanence."

REPUBLIC STEEL CORPORATION

GENERAL OFFICES YOUNGSTOWN, OHIO

Belt idler in central power.

Consideration *of* Proper Power Installation *is* Important

.. *Lease Economy* ..

Iron swinging hold-up post.

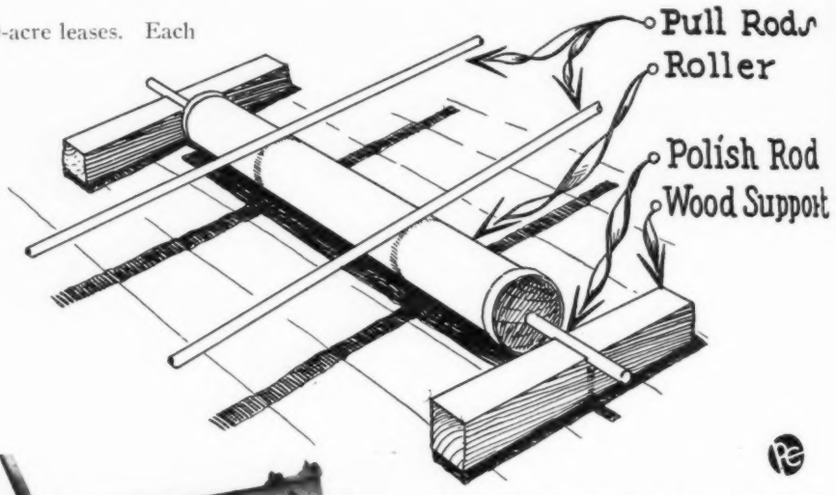
THE value of properly constructed pumping installations has been realized by oil industry engineers for a number of years, but their economy was never so important as during the present low prices of crude oils, when every saving incidental to lifting costs must be effected, particularly so on small wells.

Mid-Continent Petroleum Corporation's power plants for pumping in the Cooper area of the Burbank, Oklahoma, field are in excellent condition after many years of service, and promise to be capable of giving dependable service for many years to come. These powers were carefully installed and are properly attended.

The company has 48 wells on three 160-acre leases. Each lease has one central bandwheel power, 16 wells being on each power. They are powered by 45 horsepower, 4-cycle gas engines, fuel for which is obtained from residue gas at the gasoline plants. The usual belt installation and belt idler attachment are included in the layout, as are an 18-foot under-pull type bandwheel, with 24-inch eccentrics.

These wells are about 3,000 feet deep and have an average production of five barrels per well daily. They are operated on an average of 28-inch strokes at the rate of 10 strokes per minute. The speed of pumping is controlled entirely by the governor on the engine. When these wells were drilled, the rigs had large cellars, which have been filled in with rock and dirt, and a concrete base poured for jack foundations.

The friction load on the power has been reduced as much as possible by supporting the rod lines on proper carriers and by properly lubricating the jacks, swings, road crossings and other auxiliaries. A heavy constructed swinging type iron hold-up is placed on each rod line near the power building. The remainder of the hold-ups are stationary iron



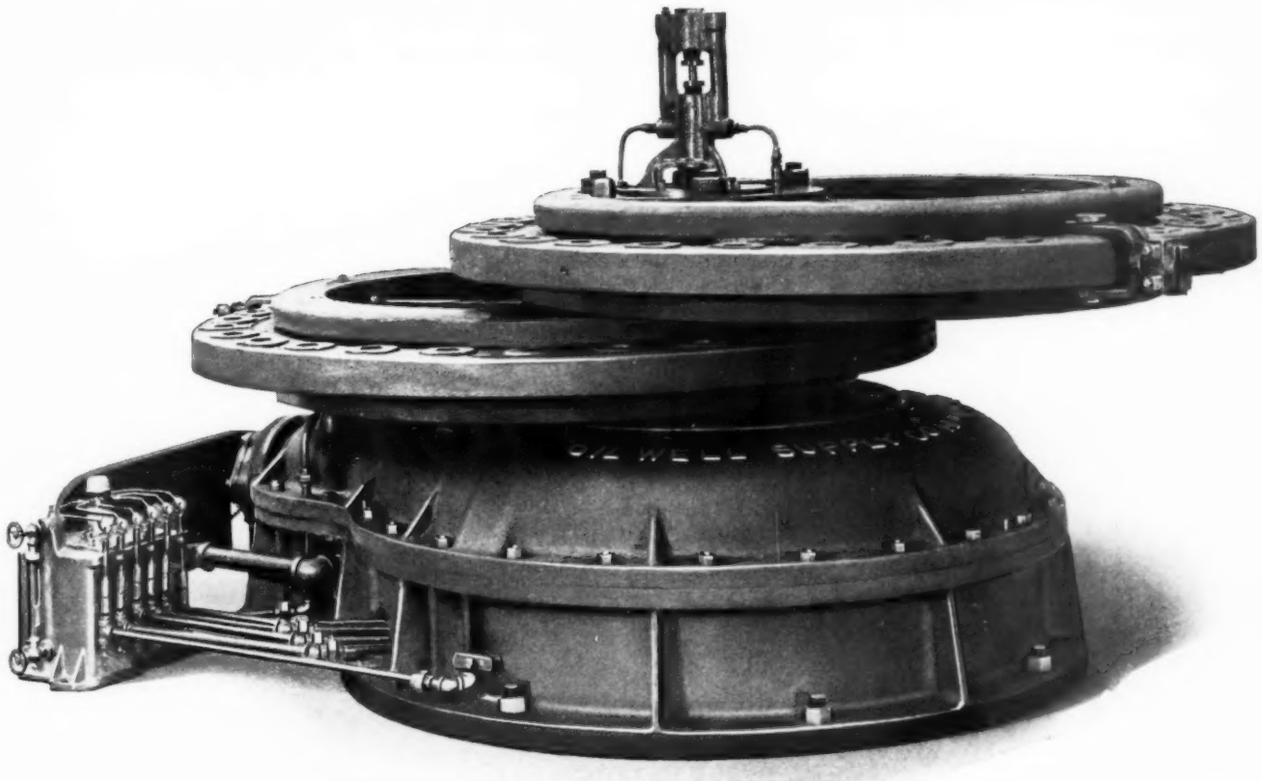
(Above) Sketch showing timber roller used as support within house. (Left) Jack on one of the wells.

pipes, majority of which are set in concrete. Knock-out posts are made of old eight-inch casing, with the rod line running through perforations in the pipe. Swings are also heavily constructed, braced and set in concrete. These have an upright piece of casing, with a horizontal projecting swing arm attached at the proper level for the rod line.

To further aid the proper support of the rod lines, a clever but simple device has been placed on the two longest rod lines in the power houses. This device is

ANNOUNCING

the IMPERIAL No. 80 OILBATH GEARED POWER



(Patents pending)

An extremely rugged and compact design of the overpull type—driven through a double reduction gear. All gears are machine cut and are entirely enclosed in an oil-tight base, running continuously in an oil bath. The eccentric bearings and all bearings not immersed in the oil bath, are lubricated by a force-feed *return system* by which clean lubricant is re-circulated.

Rated horsepower is 80 at 20 R. P. M. Band wheel powers of this capacity have greater housing expense and higher belting cost. Consult with the nearest "Oilwell" Branch on the exceptional and economical advantages of the No. 80.

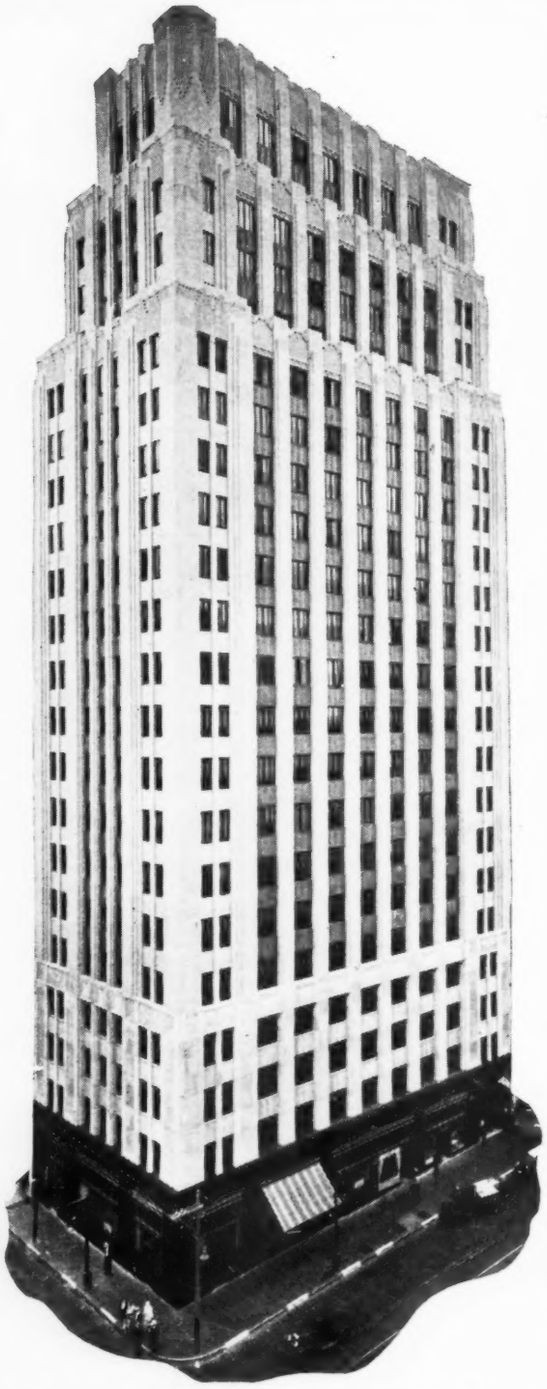
OIL WELL SUPPLY CO.

Branch Stores in all Oil Fields

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

1859

"OILWELL"



Tower Petroleum Building

DALLAS' NEWEST OFFICE BUILDING

Beautiful in design—modern in appointments—full ventilating windows—fastest automatic elevators—terrazzo floors throughout.

Single Offices, $35.00 up.
Double Suites, $90.00 up.

McNENY & McNENY
Owners and Operators
2105 Tower Petroleum Bldg. DALLAS

for the purpose of preventing the rod lines from whipping and beating on the concrete floor. An old piece of 6x6 timber has been turned down in the machine shop, after which a polished rod was placed through the center as an axis. The end of the timber piece is protected by metal rings. The polished rod is supported at each end by a wooden support, which is of sufficient height to allow free rotating of the roller as the pull rods move backward and forward across the timber.

Counter-balancing the sucker rods at the well, and offsetting unbalanced pull rods at the power with counterweight boxes, is an important part of reducing the power necessary for the operation of the wells. Unbalanced rod lines are offset by these counterweight boxes attached to the power by dummy rod lines. The boxes are constructed of old iron pipe gathered from around the lease and consist of an upright six-inch diameter pipe set on a swing, securely fastened on a concrete base. About 18 inches from the ground another joint of pipe has been welded to the vertical member, and cross bars of two-inch pipe are attached crosswise on the horizontal pipe to support three large concrete weight blocks, which are bolted to the cross bars. The jacks at the well are also counterbalanced, having small concrete blocks for weights on the back end of the lifting arm.

Another important phase in the proper balancing of these powers is the location of the houses as near the center of the 160 acres as possible, permitting easy distribution of the well loads and eliminating long rod lines as much as possible.

Wherever standard pumping derricks are not in place, 64-foot tall "A" masts have been erected for use in pulling the sucker rods and tubing. These masts are made of five-inch pipe, with cross bars of two-inch piping, reinforced by iron rods. A pulley wheel is placed at the top of the mast for conducting a cable from the tractor used as power for pulling operations.

David Donoghue

DAVID DONOGHUE, consulting engineer and geologist, Fort Worth, Texas, has been appointed federal receiver for the E. L. Chapman enterprises by the Honorable J. C. Wilson, Judge of the United States District Court, Fort Worth. The Chapman interests include 22 properties and production in East Texas, Urbana and Smackover, Arkansas, and a refinery in Louisiana.

NEILAN CO., LTD., of Los Angeles, California, manufacturers of automatic regulating and control instruments, are pleased to announce the appointment of M. N. Aitken as sales engineer in charge of the sale of Neilan Equipment to the natural and manufactured gas industries exclusively.

The recently perfected line of Neilan rate-of-flow controllers and flow meters rounds out the established line of Neilan regulators for the gas industry. Mr. Aitken enjoys a wide friendship in this industry and is an experienced control engineer as a result of his former training with the Neilan organization.

to New York will be carried at Hopewell, New Jersey. Middlewest factory stocks will be carried at Pittsburgh, Pennsylvania, and Tulsa, Oklahoma. The factory stock for the West Coast will be carried at the Oakland, California, plant.

Sales offices will be maintained at all the above points and also at Houston, Texas; Dallas, Texas; Denver, Colorado; Salt Lake City, Utah; Columbus, Ohio; Philadelphia, Pennsylvania, and Boston, Massachusetts. Additional sales offices and warehouses will be opened at strategic points as the expansion of business requires.

A large amount of new machinery is being installed in the Pittsburgh plant. Several new products are being brought out which will be added to the line or which are accessories for the present line.

The Pittsburgh Division of the Pittsburgh Equitable Meter Company was founded by the late George Westinghouse, who was the first successful public utility operator to introduce natural gas for domestic purposes. The company has been a pioneer in the development of both gas meters and regulators for the natural gas industry. The Merco Nordstrom Valve Company was founded by S. J. Nordstrom, who invented the sealed port type of lubricated plug valve and is responsible for the many improvements which have been made in the last fifteen years. Both companies have the very latest improved machinery for manufacturing their products and each company maintains fully equipped chemical and mechanical laboratories.

Colox Weight Material for Drilling Muds

COLOX, a product of C. K. Williams & Co., of California, Ltd., Emeryville, Calif., is a heavy, fine, dry mineral powder used to increase the weight of drilling muds. The manufacturers claim exceptional ease in wetting, freedom from lumps, excellent mud qualities, and ease of mixing with field muds.

Colox has a distinctive maroon red color. It has pigment properties and will stain any field mud it is mixed with and produce a maroon mud, thereby identifying the weighted drilling mud.

It is said by the makers to be absolutely harmless to both individuals and equipment, non-irritating to the skin and will not attack metal of any kind or injure equipment. Other claims made for it are the meeting of every drilling requirement for fluid weighting material, including suspension with water in a very fluid stage, easy pumping, does not settle out in ditches, resists gas cutting, is plastic, besides maintaining the factor of safety essential when gas or hydrostatic pressures are being checked.

Colox contains 80 per cent iron oxide. The concentrated weight of Colox, with its specific gravity of 4.3 and higher, makes it easy to increase mud weights to 120 pounds per cubic foot readily.

Falk Corporation Announces Lower Prices on Speed Reducers

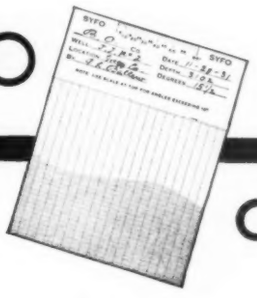
A LOWER schedule of prices on various types and sizes of speed reducers has been announced by the Falk Corporation, Milwaukee.

Falk standard speed reducers are made in single, double and triple reductions, both horizontal and vertical, for parallel shaft and right angle drives. There are 17 types in 202 sizes, ranging from 1,000 horsepower down to .05 horsepower with 133 standard ratios from 1.5:1 to 518:1. Price changes apply to all sizes in common use.

WHAT USERS SAY • No. 2

"Expect to continue using this service as long as it gives us the same satisfaction we have had in the past"

SYFO



Safe
Speedy
Accurate
Inexpensive

Clinograph

SPERRY-SUN WELL SURVEYING COMPANY
1608 WALNUT STREET, PHILADELPHIA, PA.

DALLAS, TEXAS
1501 Caruth Street

TYLER, TEXAS
Bell Building
209 N. College Street

LOS ANGELES, CALIF.
415 Petroleum Securities Bldg.

TULSA, OKLA.
402 Petroleum Building

HOUSTON, TEXAS
1417 Esperson Bldg.

CALGARY, ALBERTA, CAN.
Room 1, Central Block

Gott WATER CANS & COOLERS
Pure... clear drinking water
The GOTT Water Can is the safe, handy way to keep a fresh supply of pure drinking water always at hand wherever you may be—It's health insurance...your supply store has them. Get one today!
GotkooL
H.P. GOTT MFG. CO., Winfield, Kansas
KEEP PURE DRINKING WATER ALWAYS HANDY

The **Standard** *water can of the oil fields everywhere*

H. P. Gott Mfg. Company

W I N F I E L D , K A N S A S

The Petroleum Engineer's Third Annual Engineering Review Number . . .

On June 1st the third Annual Engineering Review Number of THE PETROLEUM ENGINEER will make its appearance. As in the past, this issue will be comprised of a group of fact-filled articles written by engineers, superintendents and other operating men of accomplishment, presenting a complete résumé of developments during the past year in engineering practices in every operating branch.

From this one issue, regular departments such as Pictorial Petroleum, New Petroleum Equipment, Personals, etc., will be omitted to make room for the greatest possible amount of review material.

Readers will find the Engineering Review of exceptional interest and permanent value.

Manufacturers who have not already reserved advertising space should do so promptly.

THE PETROLEUM ENGINEER,
Tower Petroleum Bldg., Dallas, Tex.

Guiberson Diesel Engine

THE Guiberson Diesel Engine Company's exhibit at the recent Detroit Air Show attracted much attention from aviation engineers. In addition to the exhibit several planes powered by this new Diesel engine stunted, carried passengers and entered speed tests.

The engine operates without spark plugs, ignition coils or magnetos and is said to function equally well when the plane is flying upside down, on its side, or in normal position. According to the makers, the engine uses only a small amount of fuel per horsepower hour. It has been thoroughly tried out, having been flown many hundreds of hours in severe tests under diverse conditions and has been approved by the United States Department of Commerce.

The engine is the development of Diesel practice from medium speed to high speed operation and its application to airplane practice, which demands safety, flexibility and continuity of performance. It meets the need for a less inflammable fuel burning engine.

The Guiberson patented variable control covering timing

Sectional View, showing arrangement of fuel injection system

Attracts Attention

and quantity of fuel feed to the motor has given peak efficiency whether idling or running wide open. One of the novel and startling features of this control is that it permits complete decompression of the engine while running. Through means of a single control the stroke of a pump is varied as the time of injection is advanced or retarded. The duration of the injection is varied proportionately to the amount of fuel injected and the time of ignition. By moving the control to the extreme position below idling, a decompression ring is brought into action, lifting the valve tappets, opening the valves and completely decompressing the motor, giving the engine "free wheeling" which allows the propeller to turn freely in a glide with the motor dead. Advancing the throttle again seats the valves and compresses the motor and the engine is started from a normal gliding angle. The "free wheeling" feature is said to be of great importance in facilitating inspection and service of the motor.

Another unique feature of the engine is the design of the manifold at the head of each cylinder. In high speed engines the time of combustion is so infinitesimal that nothing short of perfect mixture can yield proper combustion. The aim of high speed Diesel engine designers is to give the intake air the greatest possible turbulence. There being but one valve in each cylinder, intake air must be drawn through the same after scavenging gasses have been expelled, and the manifold must be designed to handle these exhaust gases as well as the intake air. In the Guiberson patented sinuous manifold the air, rushing through the manifold is started on its tortuous course only to be sucked back by the downstroke of the piston and sent whirling into the cylinder, there to be further contorted during compression until, at the time fuel is injected, it is a seething, writhing mass instantly atomizing the fuel and forming the highly combustible mixture desired as the heat generated by the compression becomes sufficient to ignite.

S. A. Guiberson, Jr., in speaking before the Western Petroleum Refiners' Association at Excelsior Springs, Mo., predicted Diesel power units for trucks, busses and motor boats. Main offices of the Guiberson Diesel Engine Company are located at Dallas, Texas.

Three-fourths View of Engine

The Fable of the
Man Who Bought a Hoist

A CERTAIN man contracted to raise the steel work for a great bridge . . . scheduling the work with railroad precision. ¶ No power line was near, so a 100 hp. gasoline hoist was needed. But when he went to buy, lo, there were 100 hp. hoists with engines both big and little, at prices high, and low. His bid was figured close, so he bought accordingly. ¶ The hoist did its best, but the engine was overworked . . . he didn't make his schedule. ¶ He could have bought a dozen hoists, conservatively rated, with the penalty money that he lost.

WAUKESHA ENGINES

Are conservatively rated to prevent costly shutdowns. *Write* for Bulletin 827. *Waukesha Motor Co., Waukesha, Wisconsin.*

REAL HORSE POWER NOT PAPER HORSE POWER

4

HUF-STRIPPER

(2-Cup Inserted)

LINER BARREL

An economical and efficient low price unit for your stripper wells.

Installed and removed complete with sucker rods—keeps you away from tubing jobs.

Cups are protected by outer tube. Are 100° good when put to work.

Seats on top of old working barrel. The two cups on lower valve pack off fluid and hold liner in place.

Will Reduce power cost and stress on sucker rods.

Furnished in two sizes—1 inch for 2-inch tubing and 1⅜ inch for 2 inch tubing.

Use four foot liner in five foot working barrel and five foot length in six foot working barrel.

From Your Supply Store.

The Chas. N. Hough Mfg. Co.

Franklin, Pa.

ARMSTRONG BROS.

CHAIN TONGS

for forged-in

Strength

There is extra strength, quality and service built into every part of ARMSTRONG BROS. Chain Tongs. **Jaws** have far greater purchase on the bar, are drop-forged from special steel—are treated, hardened and tested for toughness. **Handles** are forged from high carbon-steel and have both stiffness and strength. The Bolt is large, is **hardened** steel; the shackle drop forged Chrome-Nickel Steel. Chains have proven strength, are **proof-tested** to ⅔ catalog strength (3,600 to 40,000 pounds). There is no guesswork here. These are tongs that can be depended on. All sizes, either Standard or Reversible Jaw Types.

Write for Catalog B-27

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
331 N. Francisco Ave. CHICAGO, U. S. A.

The BAKER

"A BAKER HOTEL"
Dallas

700 Rooms of luxurious comfort with every modern convenience. Three of the most popular dining rooms in the Southwest, serving food that has gained wide renown. Coffee Shop open day and night, seven days a week.

Rates: $2 to $7.

Remember--BAKER HOTEL, DALLAS!

MOTORS—Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., has issued a loose-leaf bulletin sheet on type RG brush-riding repulsion-induction motors.

FRACTIONATING AND ABSORPTION PROBLEMS—A small booklet on facts touching on fractionating and absorption problems has been issued by the Leader Iron Works, Inc., Decatur, Ill. The design and function of Leader products are well illustrated and discussed in the pamphlet.

TRUCKS—International Harvester Company of America, Chicago, Ill., has published a new catalog, entitled "International Speed Trucks," which contains illustrations and descriptions of the company's full line of speed trucks.

HIGH PRESSURE TRAPS—The Armstrong Trap Magazine for March, 1932, a publication of Armstrong Machine Works, Three Rivers, Mich., has an interesting article on "How to Make Good Trap Installations."

"HOW TO RUN A LATHE," a book issued in the interest of trade, craft and mechanical training, is being distributed by the South Bend Lathe Works, South Bend, Ind. This book is the thirtieth edition, circulation of which has reached the million and a quarter mark. A charge of 25 cents is made to the general public in order to cover the cost of printing and distribution.

HENRY VOGT MACHINE CO., Louisville, Ky., has printed an interesting and amply illustrated bulletin on its new heat exchanger. When writing for the bulletin, ask for No. HE-2.

RADIANT END PLATES INCREASE STILL EFFICIENCY, a booklet published by The Calorizing Company, Pittsburgh, Pa., is a treatise by Roger Stuart Brown, engineer for the company. It is an engineering discussion of radiant end plates.

BRODERICK & BASCOM ROPE CO., St. Louis, Mo., has published a new pamphlet on B & B Flex-Set wire rope. A feature of this rope is the intricate combination of physical and mechanical characteristics have been synchronized in the making, so that the rope is fully capable of operating at top speed with full load right from the start.

DANIEL ORIFICE FITTING, a product of J. A. Campbell Co., Long Beach, Calif., is described in a new booklet being distributed by the manufacturer. The company has recently made a greatly improved new orifice design.

NEILSEN OIL WELL PUMPING EQUIPMENT, manufactured by Triangle Pump Company, Long Beach, Calif., is the subject of recent literature published by the Triangle company. All Neilsen products are described in this interesting, well-illustrated booklet.

VALVES—Fisher Governor Company, Marshalltown, Iowa, has published circular No. 830, which illustrates and discusses the flow characteristic and construction of Fisher Valves.

Leland to Handle Case Tractors

RECENT arrangements have been completed by the Leland Equipment Company, Tulsa, Okla., to handle the general line of industrial tractors manufactured by the J. I. Case Co., Racine, Wis. This line will be adapted for use of winches and other equipment handled by Leland for general oil field duties.

German Firm Opens New York Office

THE firm of Hermann Frischer Chemisch-Technisches Buro, Berlin, Germany, has, after twenty years of successful operation all over Europe, established a branch office in this country under the name of H. H. Frischer & Company, 24 Monroe Place, Brooklyn, N. Y., as consulting engineers for the Heavy Chemical Industry. Dr. K. F. Sonnenstuhl is resident manager of this office.

Instrument Lines Merge

THE Pyrometer Division of the Wilson-Maeulen Company, Inc., has merged with The Foxboro Company. The entire personnel of the Pyrometer Division of Wilson-Maeulen Company will be merged with that of The Foxboro Company.

This merger makes it possible for The Foxboro Company to offer a complete range of instruments of standardized quality.

The Wilson-Maeulen Pyrometers and Controllers will be built in the Foxboro factories at Foxboro, Mass. All communications relative to Pyrometers should be addressed to Wilson-Maeulen Pyrometer Division, The Foxboro Company.

Proposed Specifications For Western Petroleum Refiners' Association Gasoline

	WINTER	SUMMER
Gravity A. P. I.	60-62	58-60
I. B. P.	100° F. Max.	110° F. Max.
10% Evaporated	140° F. Max.	155° F. Max.
50% Evaporated	284° F. Max.	284° F. Max.
90% Evaporated	392° F. Max.	392° F. Max.
End Point	420° F. Max.	420° F. Max.
Recovery	95% Min.	95% Min.
Doctor	Without Residue	Without Residue
Non-Corrosive	Sweet	Sweet
Color	3 Hrs. at 122° F. Plus 25 Min.	3 Hrs. at 122° F. Plus 25 Min.
Filtration through one thickness of filter paper shall be permitted.		
Gum Content (Copper Dish)	30 mg/100 cc. Max.	30 mg/100 cc. Max.
Gum as determined by average of 3 determinations run simultaneously.		
Vapor Pressure—Reid Method	12 lbs. @ 100° F. Max.	10 lbs. @ 100° F. Max.
Sulphur	0.1% Max.	0.1% Max.
Acidity	None	None

All methods of testing shall be in accordance with A. S. T. M. methods.

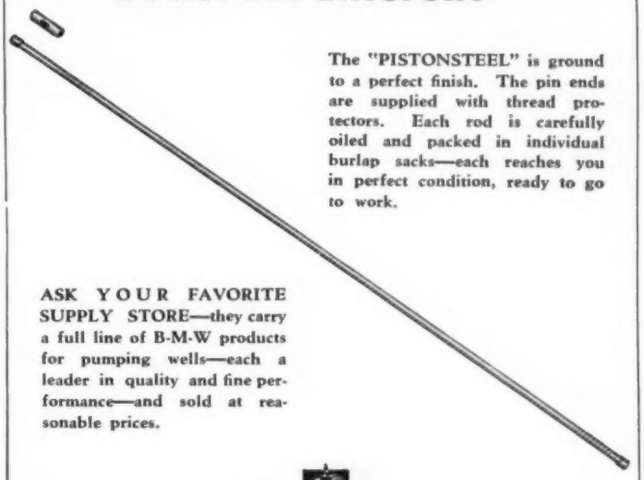
There shall be three grades of gasoline of the above specifications. These grades to be—Under 57 octane; 57 to 65 octane; and 65 octane and above.

Octane Number—To be determined in accordance with the standard method prescribed by the Standard Oil Development Company, using the "CFR" engine or Ethyl Corporation Series "30" engine, and reference fuels A-2 and B-2.

It is distinctly understood that all specifications are for gasoline in bulk at point of delivery.

B-M-W PRODUCTS for pumping wells
The KEY to LOWER LIFTING COSTS
CORRECTLY DESIGNED • • ECONOMICALLY PRODUCED
REASONABLY PRICED

"PISTONSTEEL"—
a polished rod that is better . . . different



The "PISTONSTEEL" is ground to a perfect finish. The pin ends are supplied with thread protectors. Each rod is carefully oiled and packed in individual burlap sacks—each reaches you in perfect condition, ready to go to work.

ASK YOUR FAVORITE SUPPLY STORE—they carry a full line of B-M-W products for pumping wells—each a leader in quality and fine performance—and sold at reasonable prices.

BRADFORD MOTOR WORKS INC.
OIL WELL SUPPLIES
BRADFORD, PA. TULSA, OKLA.
EXPORT OFFICE—30 CHURCH ST.—NEW YORK CITY

H H
minimax
If you have never stopped at a Hilton Hotel, ask one of your friends or business associates about us.
Our service, our food, our accommodations, and last but not least, our never changing rates of $2.00, $2.50 and $3.00.
Dallas, Waco, Marlin, Lubbock, Plainview, San Angelo, Abilene, El Paso
H H
HILTON HOTELS, Inc.
C. M. HILTON, PRES.

Many Novel Features at

HOUSTON OIL COMPANY'S CAMDEN PLANT

By
R. H. COOK,
Chief Chemist
Camden, Ark., Refinery of Houston Oil Co.

THE loading rack in any refinery plays a great part in maintaining uniform products. Before loading, tank cars should be inspected, cleaned or repaired as needed, and by all means, drained of small amounts of water and remaining product with which it was previously loaded. Cleaning or repairing a tank car is dangerous when practiced without first steaming the car for at least two hours. Connection for steam can be made midway between every other spill on the rack and will be in reach of any car with the use of one section of one-inch steam hose. With this installation cars needing cleaning or repairing can be steamed out, repaired and loaded in a day.

Loading Rack at Camden Plant

Refineries confronted with the installation of recovery systems for loading racks, and with inadequate fall for drainage in the contour of the ground, can be fitted with a first-class recovery system at a very small cost. A ditch is dug just at the end of the ties on the rack running full length of the rack with a two-inch fall for each car spot. At the lower end of this ditch, which should be nearest to the crude or treated pressure distillate tanks, a hole is dug to accommodate a 550-gallon underground storage tank with air connections and connections for discharge to crude or treated pressure distillate tanks. A two-inch line is laid in the ditch with two-inch by two-inch by one-inch tees placed at each outlet spot. These tees are fitted with one-inch nipples just long enough to clear the ground surface two or three inches. Old one-inch armoured hose are connected to these nipples and to small tubs which can be placed under the outlet leg. A small conical strainer can be made and inserted in the outlet of the tub to keep rust and scale from going into the line. When the storage tank is full it can be blown to storage for rerunning. The gasoline recovery from this system will soon pay for its installation.

Cars often have the valve disconnected and must be unloaded in other than the conventional manner. A small inexpensive connection can be made, using pipe fittings, which will do the job. A two-inch nipple is fitted into the outlet cap, then a two-inch by two-inch by two-inch tee is fitted on this nipple and running connections for unloading are made to this tee. The end of the tee is fitted with a two-inch by one-inch bushing and a piece of one-inch pipe, long enough to reach the valve, and six inches over, is threaded about seven-eighths of its length with pipe dies. This one-inch pipe is fitted with a cap on the lower end and is threaded in the bushing until it comes in contact with the valve. A few turns with a pipe wrench will open the valve.

One expense most racks have is the expense of tacks for placing placards on cars. The use of new tacks is not only expensive, but will in time fill the placard boards so full of tacks that a new placard cannot be placed on correctly. A small tack puller can be made by flattening the end of a short piece of reinforcing rod, splitting it and bending the end up slightly, which can be used surprisingly fast and will furnish plenty of used tacks which prove just as good. This will just about eliminate the surplus of rusty tacks so common to a placard board on a tank car.

Treating Plant

When it is desired to dissolve solid caustic soda in a given amount of water, a unique arrangement can be made by building a stand over a tank of suitable volume to hold the combined water and caustic. A sheet iron tub which will hold the stick of caustic is placed directly over the tank on the stand and is fitted with a two-inch connection down to the bottom of the tank. Then a one-inch line comes out of the top of the tank and goes overhead and spills on the stick of caustic. The system is filled full of water, leaving room for the volume of the dissolved stick of caustic. As the caustic dissolves it will increase the specific gravity of the solution. This added weight will displace the water and force it back overhead. This will continue until all the caustic is dissolved. Addition of a small amount of steam to the stick will accelerate solution.

All pressure distillates will keep better if they are given a caustic wash as soon as possible after they are condensed. A very convenient caustic wash can be placed in the run-down line from the crackers at small cost. A piece of eight, ten, or twelve-inch pipe about eight feet long is placed on end. A base plate is welded on the bottom end and a

set of companion flanges are blinded on the top. This pipe is packed with broken castings and both caustic and pressure distillate enter the bottom. Pressure distillate leaves the top and the caustic is removed in a settling drum. The pressure distillate then passes on to storage to be treated later.

Laboratory

Where the laboratory is small and desk space is limited, the distillation apparatus can be arranged for minimum space and handiness in the following manner: Two machines are placed end to end near the back of the desk with the burner hoods together and the doors side by side. Just in front of these, leaving the width of the back burner hoods between, two more machines are placed in similar manner. This way the operator can stand in front of the V-shaped arrangement and read all points on four distillations without moving.

Indexed Cable on Tank Suction Line.

Many thermometers are broken in a laboratory where there is no safe place to keep them. A neat and efficient way to keep thermometers safe and accessible is to place two ring eyes about four inches apart in the ceiling directly over the location of the flask hole in the machine. Cut out a piece of lead to weigh the same as the thermometer, run a piece of silk fishing line through the ring eyes, tie the thermometers to one end and the lead to the other leaving enough string between them to enable placing the thermometer in the flask and have the lead well up out of the way. When through with the distillation, the thermometer has only to be loosened and lifted out of the way where it remains.

Any operator of distillation machines knows that when a machine is fitted to one flask, that flask will work better on that machine. In order to keep them with the machine to which they are fitted a bored cork is pressed over the end of the rod on the ring stand, leaving about six inches of the rod protruding. The flasks, while hot, may be inverted and placed over this rod, the rim resting on the cork, where it may cool. A small groove in the cork will let all vapors and liquid drain out of the flask. No rinsing and drying is necessary where this is practiced.

In a laboratory where there is not enough light to read the ten per cent points on the graduated cylinder, a piece of white cardboard may be placed just back of the recovery cylinders. It is also handy to place a very few small pieces of dry dye in the cylinder at the start of the distillation. This will color the fluid in the cylinder so that it can be easily seen.

Retaining samples of tank cars is a problem in some laboratories. One of the best methods is to construct a cabinet with, say, thirty compartments in rows of six, five high, each row with a separate door opening down and running lengthwise. Each compartment is designed to hold samples for a maximum day's loading. The outside can be indexed for each day of the month. This will retain each sample for thirty days.

Pump House

An operator in the pump house can oil most movable joints on a pump, but there is one place, the spool on the pump rod, where the rocker arms work, that can not, on most pumps, be kept oiled. A tinsmith can make a cup to go around this spool with ends soldered in and packed where the rod passes through. This can be filled with waste and oil and clamped to the rod with hose connection clamps. This will keep the bearing oiled with very little attention.

On a steam pump where a visible lubricator is used, the glass tube can be made safe by cutting a piece of screen the proper size to form a cylinder around the glass. This will prevent glass from flying out in case of a break in the tube.

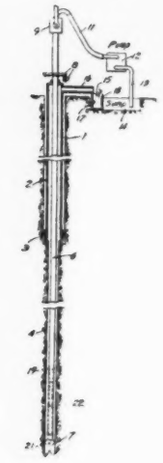
Stills

Every stillman dreads the regular taking of samples, weighing them, emptying the cylinder and placing the hydrometer back in the frame. This can be eliminated by the installation of a metal weighing cylinder with quarter-inch pipe connections soldered to it, one in the bottom and one about one-half inch from the top. The bottom one is connected to the sample line on the look box, the top one is connected to the down leg from the look box, then the hydrometer is placed in the cylinder and left there. The operator has only to read the gravity, lift it up, and record the temperature. It is always ready.

On stills without automatic water separators to remove water from the stream, the use of a water separator leg with hand-valve control proves very unhandy and requires much attention. A very simple device can be made to do this job in a semi-automatic manner by fitting on the end of the water valve an inverted "V" vented at the top with a piece of pipe, which will extend above the level of the gasoline in the system, to keep down syphon effect. The outlet from this "V" passes out to the water sewer.

Storage tanks equipped with suction swing lines can easily be indexed so the operator can tell at a glance just where the suction is at all times. When the tank is empty the suction is lowered to the bottom and this point is marked on the cable outside opposite a suitable stationary indicator hand. The suction is then raised one foot at a time and each point marked on the outside of the cable. Then with solder a small raised face can be made at each one-foot mark on the cable, and this can be stamped with dies. By dividing these one-foot marks into twelve equal spaces a fairly accurate gauge can be kept on the suction's location to within one-quarter inch.

NEW PATENTS OF THE INDUSTRY

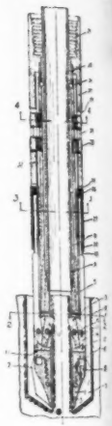


1,850,399. APPARATUS FOR INDICATING EXCESSIVE DEVIATION OF DRILL HOLES FROM THE VERTICAL. JOHN J. JAKOSKY, Los Angeles, Calif., assignor to Drill Guide Incorporated, Los Angeles, Calif., a Corporation of Nevada. Filed Mar. 11, 1929. Serial No. 346,223. 10 Claims. (Cl. 255—1.)

1. An apparatus for indicating excessive deviation of a rotary drill hole from the vertical during drilling thereof, comprising, in combination with a rotary drill including a drill pipe, means adjacent the lower end of the drill pipe containing a quantity of indicating agent, and means at the lower portion of the drill pipe and responsive to deviation of such portion of the drill pipe from the vertical and operable only upon continued rotation of the drill pipe while such deviation exceeds a certain angle to cause delivery of said indicating agent to the circulating fluid adjacent said portion of the drill pipe.

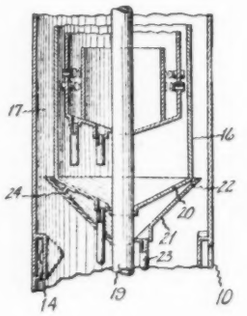
1,850,434. CORE CATCHER FOR WELL DRILLS. LOUIS H. WELLENSIEK, Houston, Tex., assignor to Hughes Tool Company, Houston, Tex., a Corporation of Texas. Filed May 13, 1929. Serial No. 362,645. 14 Claims. (Cl. 255—72.)

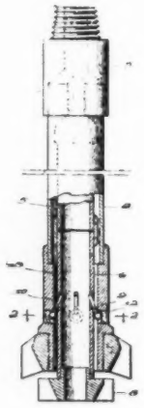
1. A core bit, an upwardly extending nipple thereon, a drill collar telescoping over said nipple, radial pins on said nipple projecting into openings in said drill collar, and having a limited longitudinal play therein, core engaging dogs in said nipple, and means on said collar adapted to engage said dogs to move them into core-engaging position.



1,850,430. DRIP BASIN FOR FLUID SEPARATORS. JAY P. WALKER, Tulsa, Okla. Filed Dec. 3, 1928. Serial No. 323,513. 3 Claims. (Cl. 183—2.7.)

1. In a fluid separator, the combination with an upright tank having inlets in its sides for influent fluids, and a shell within the tank in the path of the influent, of a basin underlying and separate from the shell having a free annular lip for catching the liquids dripping and falling from the outer surface of said shell.

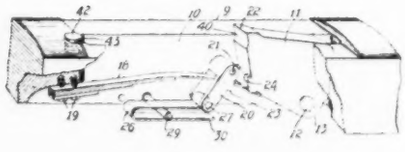




1,850,386. CORE RETAINER. CHARLES A. DEAN, Bakersfield, Calif. Filed July 19, 1930. Serial No. 469,124. 6 Claims. (Cl. 255—72.)

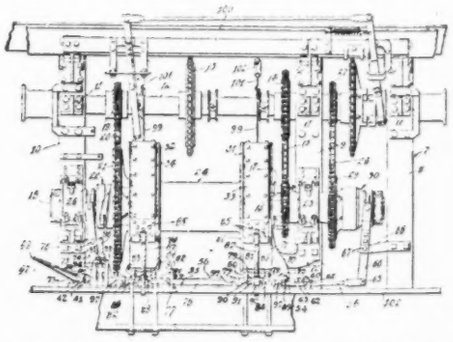
1. A drill having an inner core barrel, dogs seated externally thereof and extending into said core barrel and capable of limited movement in all directions.

1,850,185. RIPPER FOR WELL CASINGS. FERDINAND J. SPANG, Butler, Pa. Filed Feb. 27, 1930. Serial No. 431,770. 6 Claims. (Cl. 81—188.)



1. A ripping tool for well casings comprising a body having a longitudinally extending slot therein, a cutting tool in one end of said slot pivotally mounted therein for ripping when said tool is moved in one direction, and a cutting tool stationarily mounted on said body at the other end of the slot, said latter tool being so located that as the body moves in the opposite direction, it will traverse the path of travel of the pivotally mounted tool so as to remove any obstruction caused by said pivoted cutter.

1,850,607. CONTROL FOR ROTARY DRAW WORKS. JOHN D. SPALDING, Crafton, Pa., assignor to The National Supply Company of Delaware, New York, N. Y., a Corporation of Delaware. Filed Apr. 1, 1929. Serial No. 351,813. 9 Claims. (Cl. 254—187.)



1. A control of the character described comprising the combination with a derrick floor and a drawworks having a brake drum and a band therefor and a frame of a unitary plate adapted for overlying the derrick floor and for connection with said frame, brake band operating mechanism mounted on said plate adapted for connection with one end of the brake band, and a means mounted on the plate to anchor the other end of the brake band to said plate independently of said mechanism.